TANGANYIKA TERRITORY

DEPARTMENT OF AGRICULTURE

Annual Report

1934

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DEPARTMENT OF AGRICULTURE

ANNUAL REPORT, 1934

Staff.

The Director was in control of the department throughout the year. Mr. L. A. W. Vickers-Haviland from the Administration served during the first three months of the year as Assistant to the Director, until he went on vacation leave in April. During the remaining nine months of the year, part-time assistance was rendered by Mr. J. V. R. Brown, District Agricultural Officer.

At the close of the year the staff authorized was :—

Head Office: Director; three European Clerks and part-time assistance from the Senior Agricultural Assistant.

Coffee Research and Experimental Station: Chief Scientific Officer, in charge; Agricultural Chemist; one District Agricultural Officer; one Agricultural Assistant; one European Clerk; with the Entomologist and Mycologist stationed there.

Sisal Research and Experimental Station: Towards the end of the year one District Agricultural Officer and one Agricultural Assistant were appointed to the Sisal Station, and transferred to Tanga.

Experiment Stations: A District Agricultural Officer is in charge at each of the Cotton Experiment Stations, viz. Mpanganya, Morogoro, Lubaga and Ukiriguru; and three Agricultural Assistants are employed on the extensions to these stations, whilst the Agricultural Lecturer is employed at the Nyakato Agricultural Training Centre. One District Agricultural Officer and one Agricultural Assistant are employed at the Tobacco Station at Iheme, Iringa. In the case of the above experiment stations, wherever possible, the Agricultural Officer carries out work in the district.

Field Staff: The remaining members of the staff consisting of three Senior Agricultural Officers; nineteen District Agricultural Officers; fourteen Agricultural Assistants; and three District Foremen are almost wholly engaged in field work; one Senior Agricultural Assistant also undertakes field work in addition to his duties as Coffee Grader.

Scientific Staff at Morogoro: Assistant Entomologist.

New appointments made during the year: N. M. Wight, District Agricultural Officer; H. Gillman, District Agricultural Officer (promoted from Agricultural Assistant status); H. L. Brett, C. B. Gibbins, H. A. B. Fowler (promoted from District Foreman status), R. J. M. Swynnerton, and A. E. Twells, Agricultural Assistants; B. R. D. Eccles, temporary Agricultural Assistant; C. E. Allen, J. R. Anderson and A. F. Crosskill, District Foremen.

Finance.

The total vote for the service of the department during 1934 was reduced by £4,130 as compared with the amount provided for 1933. A sum of £35,754 was devoted to "Personal Emoluments" and £23,072 was available under

"Other Charges." Of the sum of £23,072, no less than £7,695 was applied as contributions to agricultural activities outside the department. During the year, however, the activities of the department were reinforced by a contribution from the Colonial Development Fund of £5,000 for the payment of part of the staff and upkeep of the Coffee Experimental and Research Station now being established at Lyamungu near Moshi. Further and valuable assistance was forthcoming from the Empire Cotton Growing Corporation, which gave £3,840 per annum recurrent and a capital grant of £6,850 for the establishment of two cotton variety multiplication farms; it also enabled the department to re-open the Cotton Experiment Station at Mpanganya (Rufiji District) and better to equip and staff the experiment stations at Ukiriguru, Lubaga and Morogoro. In the last quarter of the year, work was commenced on the establishment of a Sisal Experiment Station near Tanga, funds for this purpose being provided jointly by the Colonial Development Fund and the Sisal Tax. Furthermore, a sum of £1,750 was provided, additional to the 1934 estimates, for the purpose of forwarding agricultural developmental work in the Lindi Province including the appointment of three district foremen, and there was unavoidable expenditure of over £5,600 during the year for anti-locust measures. Thus, despite a somewhat lower initial appropriation, the activities of the department were not curtailed but rather accelerated and expanded.

Direct revenue, apart from the contributions from the Colonial Development Fund and the Empire Cotton Growing Corporation, secured by the department shows an increase : Bukoba grading fees yielding £2,628; margin on tobacco sales £1,250; Sisal Tax £2,464; Coffee Tax £1,600; Cotton Tax £3,100; and general sales about £600; totalling approximately £11,500 for the year.

A table showing the provision made for expenditure during 1934 and the amount estimated as expended during the same period will be found in Appendix V.

In view of the fact that the report for 1933 was somewhat long and detailed, and that conditions do not change so greatly as to provide material for a survey without repetition, it is not proposed to draw particular attention to matters which perhaps have been exhaustively treated in foregoing reports.

GENERAL REVIEW OF THE YEAR.

(By the Director.)

It has again to be recorded that the season was patchy, the Lake Province suffered from a mid-season drought which adversely affected the grain and groundnut crops. Cotton is able to withstand dry conditions. The heavy rains were deferred until the month of April, being six weeks late generally, and they continued, particularly to the east of the Rift Valley, until August with disastrous effects on the cotton crop in those areas. Locusts were present in all provinces and contributed to the general uncertainty. In addition to causing added work for and anxiety to the cultivator, in some areas they wrought much destruction and surplus production could not be anticipated. Despite these serious drawbacks the general showing for the year is fairly good. Bukoba, for instance, exported a record crop of coffee. The maize crop in the Northern Province was scarcely damaged and heavy yields were secured. The cotton crop in the Lake Province is a record, and the general surplus of grains is to be commented on even though yields were depressed.

The above, although somewhat dismal reading, did not unduly depress the ultimate result from the Territory's efforts; and it is certain that although some parts of the territory may experience a poor season other parts at the same time show surpluses of considerable dimensions. In this large territory it is unlikely that every province can enjoy a bumper year at the same time. With such a diversity of conditions the prospects are almost sure to be mixed ones, and in this lies in part the strength of this territory. The production of the country is becoming broader based, although it always has had this attribute, it is becoming more marked each year; and it is important that this tendency be accentuated. For instance, there are now at least four main commodities which should, in the very near future, each be worth an f.o.b. value per annum of over half-a-million pounds. They are sisal nearing the million mark, coffee almost half-a-million, cotton and gold at present £300,000 each, but marching rapidly to the half-million value mark. Then there are several secondary products which vary in value between £50,000 and £150,000 per annum—all susceptible of a significant increase. They are hides and skins, rice and grains, groundnuts and tobacco (manufactured and unmanufactured), supported by a number of minor productions usually worth £50,000 or less per annum, such as wax, copra and sesame. Gold is included in the review, as so much of the value is represented by agricultural supplies and labour.

In view of the size of the population of the territory, and the fact that many groups of people live in areas hitherto hardly served by transport, it is to be expected that in the ordinary course of events the surplus production of previously untapped areas will reach the markets and thus help the general condition of the territory.

The table which has appeared in earlier reports dealing with the tonnages and values of agricultural exports has been brought up-to-date, and is printed here. It will be noted that there has been a contraction in the tonnage exported compared with 1933 directly traceable to the fall in tonnage of the groundnut crop, but that in five commodities export tonnages have increased over the 1933 records.

Despite criticisms of the policy of increasing production, there is no question of its utility and, as a direct result, there is now much more faith in the stability of the territory. It is important too that groups of people who had

no idea of anything but a life with a bare subsistence should be encouraged to do something more than that; and the shillings they have earned are merely the tokens which indicate their ability to do better when times improve. It would be peculiar for an under-producing country to hesitate about or restrict production merely because of feared excessive production elsewhere. It is a simple matter to demonstrate that the f.o.b. value of our agricultural exports is about Shs. 8/- per head of the population, and that the surplus yield per head is slightly more than half-a-hundredweight of mixed produce.

At any rate there is no intention of restricting or failing to encourage production, save in *specific* cases where co-operation with other producing countries is essential, and where the interests of the territory are served by conformity. In the last report, reference was made to the steady development of departmental activities. During the year new ventures have been started which will be mentioned either under the crop heading or under the provincial heading, or both.

Development.

Coffee planting is continuing in those areas in which the crop has been found to flourish, and despite low prices it is surprising how much is being done. With tobacco there has been a spectacular increase, but the volume of production is really very small. Many sisal plantations have been overhauled, replanting and extension of new planted areas may be noted in several districts, whilst there is a small but steady importation of decorticating machinery. In the Eastern and Northern provinces more land is being cleared for cotton and maize growing by non-natives, and cane planting on a new sugar estate is well forward. People are constructing small irrigation works in the drier areas, native groups are showing activity in this respect. Several dams have been built and a number of boreholes sunk during the year. In this over-ginned country people are now anxious to invest money in new ginneries. Natives are tending to co-operate in marketing. Development is being accelerated in the Western Province in many directions, especially with cotton. The non-native planter is more readily applying anti-erosion methods in his farming practice. With the native population the application of these measures in their cultivation is now much more readily marked. One may observe the continued growth of internal markets, mainly as a result of mining activity. On the whole, though machinery for agricultural development is coming in slowly, the situation to-day appears more "live" than it has for three or four years. The road programme projected must obviously be followed by additional development of the agricultural industry. An increase in the purchasing power of the agricultural population will very soon be reflected in prosperity for the purely pastoral population, with a marked effect on the territory's position.

Export Crop Estimates.

In several instances these have been seriously upset by the vagaries of the season and locusts. The main shortfall is with groundnuts : some 12,000 tons below the estimate, and beeswax shows a shortfall due to poor flowering of bush trees consequent on dry conditions very early in the year. The table below shows the comparison between the estimates and the actual exports :—

	Sisal Tons	Coffee Tons	Cotton lint Tons	Groundnuts Tons	Beeswax Tons
Estimate issued on 1st April, 1934, crops surplus for export	70,300	10,094	5,670	19,499	658
Actual export for 1934	72,510	14,766	5,645	8,036	407

PRODUCT	Maximum Output for Export prior to 1934		1932				1933				1934				*Amount of Preference granted in accordance with the Ottawa Agreements
			Amount	Total Value	Value per ton f.o.b.		Amount	Total Value	Value per ton f.o.b.		Amount	Total Value	Value per ton f.o.b.		
	Year	Tons	Tons	£	£	s.	Tons	£	£	s.	Tons	£	£	s.	
Sisal	1933	69,600	60,554	698,202	11	10	69,600	881,772	12	13	†£72,510	†847,562	11	14	India 10% *ad val.*
Hides and Skins ...	1933	4,140	2,718	99,474	36	12	4,140	165,382	39	11	3,459	134,369	38	17	Nil.
Cotton Lint	1933	5,075	3,209	183,747	57	5	5,075	276,864	54	11	‡5,645	326,613	57	17	Nil.
Copra	1928	9,318	7,265	64,694	8	18	8,157	62,160	7	12	5,730	32,596	5	14	U.K. 10% *ad val.*, India 10%.
Groundnuts	1933	19,177	15,873	182,010	11	9	19,177	166,223	8	13	8,036	60,145	7	10	U.K. 10% *ad val.*
Beeswax	1933	680	391	31,965	81	15	680	52,751	77	11	407	32,707	80	7	U.K. 10% *ad val.*
Coffee	1933	12,718	11,362	463,597	40	16	12,718	429,523	33	15	‡14,766	495,237	33	11	Per lb. U.K. 1d., New Zealand 1d., Newfoundland 2 c., India 1a., South Africa 1d., Southern Rhodesia 1d.
Sesame	1932	4,811	4,811	50,130	10	8	4,441	41,845	9	8	3,740	31,150	8	7	U.K. 10% *ad val.*
Rice	1933	6,293	5,385	62,939	11	14	6,293	62,382	9	18	6,259	76,626	12	5	Per lb. U.K. 1d. (Clean husked).
Millet and Mtama	1928	7,732	3,529	14,911	4	4	2,845	10,560	3	15	2,735	12,240	4	9	Nil.
Maize	1932	2,823	2,823	11,999	4	5	868	2,665	3	1	‡2,901	10,378	3	11	U.K. 10% *ad val.*
Gums (Arabic and Copal)	1932	1,033	1,033	15,540	15	1	1,015	15,239	15	0	‡1,124	22,031	19	12	Nil.
Ghee	1913	1,287	359	16,848	46	19	480	19,586	41	4	662	26,926	40	13	Nil.
Total ...		144,687	119,312	1,896,056	15	18	135,489	2,186,952	16	2	127,974	2,108,580	16	9½	

*Vide General Notice No. 1355 of 28th November, 1932. †New high record export tonnage. Add Sisal (manufactured), tons 754, value £18,458.
‡New high record export tonnage.

Marketing.

Extended reference was made to marketing in the report for 1933, and on account of the interest and criticism evoked by any change it will always be a topic of considerable interest. For years the trader has done much as he liked and beyond the murmurings of producers and those whose interest it is to assist and guide them there was no particular opinion than that held by the common trader. The day was sure to dawn when the situation would be examined with at least a view to the correction of evils, even if only in the moral interests of the indigenous inhabitants quite apart from their material interests. The opportunities were so easy that petty traders in the districts multiplied out of all proportion to the volume of produce to be collected, and they will continue to increase in numbers until it becomes necessary for a buyer to know something about the crop he is buying.

As producers become more literate—and in many districts quite 90 per cent. of those who take produce to market for sale are unable to read or write or to calculate and reason rapidly—there will be less need for their protection, but for the next fifty years at any rate they must be safeguarded with fairness to all parties. It has been averred that traders have encouraged production. *Prima facie* this appears true but not in every case. There is a clear instance in the Southern Highlands with the native coffee crop, where experience has shown that the established trader is far more concerned with making an immediate profit than in fostering the crop; in fact he does not know how to do this. The only market he knows is Dar es Salaam, and he is offering prices for valuable parchment coffee based on the price of clean coffee for consumption in Dar es Salaam less fifty per cent. profit, with the result that the native is being paid prices comparable with prices in Bukoba, when the coffee is worth about £80 per ton clean in London, i.e. twice the price of Bukoba coffee. Furthermore, he is unable financially to purchase the whole crop so that only a portion is sold. Obviously it is necessary to devise a scheme for marketing because of the inadequacy and ignorance of local trade endeavour. Wherever production in a district remains static it is wise to examine the conditions and factors operating. Protective duties, lack of enterprise on the part of traders, failure to develop and encourage the people, communications and many other factors will be found to have some bearing on the progress of production. No province should be content to meet the local demand alone but should strive to enter the larger markets outside the territory.

As experience is gained it is becoming obvious that several classes of native produce must be marketed by collective or group methods, and whilst this may appear to be an expensive method of dealing with a small volume of produce yet the expenses can surely not exceed the margins required by country buyers, quite apart from losses incurred over the scales by individual producers. A computation was made in a certain district which indicated that by regulating and supervising the marketing of one crop an additional £5,000 at least went into the hands of the natives of the district: which sum would otherwise have enriched the buyers who were being paid by their employers for their services. There is a recent instance of attempted litigation between two buying partners, not as regards the agreed profits of the enterprise but as regards the division of a surplus of produce secured by the ability of one of them with the scales. An instance arose last year in which it was found that although a buyer had bought and paid for a certain quantity of produce in his store an eighteen per cent. additional margin had been obtained without payment.

Administrative and agricultural officers are all agreed that without carefully supervised marketing native enthusiasm for surplus production is sure to wane, which in the long run will harm the trader as much as anyone. Under the ideals of free competition and free trade, honestly interpreted by those who hear the qualities of these principles expounded, there exists a cover of which the fullest advantage is taken both for profit and fo he support of a needlessly large buying staff. The honest trader—and there are a number—has to suffer restraint because of the qualities of some who are not so minded.

An administrative officer is studying co-operative systems and methods elsewhere in order to act as Registrar of Societies in this territory: he will find that progress in the right direction has been made. Native tobacco growers in Songea are desirous of forming a society for the disposal of their tobacco crop; in the Rungwe District native coffee growers are grouping themselves preparatory to forming a society for the disposal of their increasing coffee crop, and in the Morogoro District a number of natives combined in selling their cotton crop in bulk to the ginner direct; it may thus be inferred that there is a growing movement amongst the people for collective bargaining. The department finds that where people group themselves for the production and realization of coffee, they are able to exert a salutary influence on individuals in the group as regards both the preparation of their coffee and the condition of their plantations. This form of influence might be used in the combating of famine when that is induced by disregard of warnings and advice and by the indolence of numbers of individuals, as it sometimes is.

Local Production for Local Consumption.

The efforts made by the farming population to meet local demands are praiseworthy, but the development of cool truck or refrigerator transport with refrigerator equipment at ports must await a greater and steadier demand for local perishable products. As is to be expected, the development of industries such as that of sugar and tea, tobacco, fruit and so forth will further displace the imported article. The vast potential consuming population of this territory must, however, first be made more prosperous and become possessed of more spare cash before it may become a significant consuming factor. Regard must also be had to the price at which these adjuncts to a higher standard of living and variety of diet are offered to the population; which leads to the question: What is the most potent factor influencing increased production by natives; is it taxation or the desire for a higher standard of living?

Agricultural Shows.

Native agricultural district shows are now a feature of the year in the Lake Province and arouse much enthusiasm and interest amongst Europeans and natives alike. In the Northern Province a successful farmers' show was held under the auspices of the Sanya and Ngare-Nairobi Planters' Associations.

Agricultural Training.

The scheme mentioned in the last paragraph under this section in the report for 1933 has now some into being, mainly as a result of the generosity of the Empire Cotton Growing Corporation which has enabled the department to re-start the cotton station at Mpanganya, Rufiji, and to open up two large cotton farms—one in the Lake Province and the other in the Eastern Province—for the multiplication of new strains of cotton produced on experiment stations by those officers who are concerned with cotton improvement.

From the native employees on the two large farms individuals have been and will be selected for training as peasant farmers and will be settled on land within the influence and reach of the staff on the farms. This proposal has been taken up seriously by the Administration in the Lake Province and by the native authorities, so that on the experiment and demonstration seed farms at Ukiriguru and Lubaga a number of natives are being trained to become peasant farmers.

The Agricultural Training School for Coffee opened at Nyakato, Bukoba District, two years ago has made good progress under the management of Mr. A. E. Haarer, Agricultural Lecturer, supported by administrative, veterinary, forestry and medical officers. Pupils in educational establishments in the territory for some reason all expect to be provided with work in a government department when they have completed their course. This department cannot offer employment under Government and this fact may affect the type of pupil attracted by the school. Its aim is to train better agriculturalists not wage-earners. It is worthy of consideration whether some scheme for the settlement of good pupils might be evolved. The work and aims of the school are known to the native coffee growers of Kilimanjaro, who now desire a similar establishment on the mountain.

Several youths have requested to be allowed to work without remuneration both on the coffee station and under agricultural officers, not with the idea of becoming salaried employees but of learning how to become better peasant farmers. These applicants have been taken on as pupil-instructors on a nominal subsistence wage, they work with experienced African instructors and they accompany the agricultural officer in the field. The desire for better farming knowledge is also seen in the fact that various native communities are vocal in their demand for more and more assistance from agricultural officers.

Native Development.

The matter of concentration of population in sparsely populated areas—particularly in fly country—was mentioned in my last report; and during the year this effort has continued. Broadly, the mechanism is mainly the affair of the Administration advised by the Medical Department, the economic development of the concentrations, where that is possible, is the business of this department in conjunction with the Administration. Advance is to be noted chiefly in the district of Biharamulo and in Kibondo; in the first-mentioned district the chief economic crop is tobacco which is being fostered by means of a native agricultural society guided and assisted by the administrative officer and an officer of this department. This society has been helped by a generous gift of buildings made by the British Cotton Growing Association. The Kibondo and Kahama concentrations adjoining Biharamulo should in time join in this organization, which will be helped when the projected road to a port on Lake Victoria is completed.

Concentrations in the southern part of Kibondo are served by roads from Uvinza Station, and it is understood that they have come well through their first year.

In other districts like Musoma, Singida and so on concentration is proceeding on some scale; in Handeni a suggested programme is under consideration. In dry but fertile areas orderly concentration with prosperity can be achieved through the medium of the development of irrigation systems. This subject has been given attention during the year.

On the other hand there are a number of districts where the people are

far too concentrated, almost to the extent of their children being practically landless. Not that there is no land but the country available must first be opened up under some organized scheme. This is being attempted in the vicinity of the large cotton farms, established by the generosity of the Empire Cotton Growing Corporation in the Morogoro District of the Eastern Province and the Uzinza and Shinyanga districts of the Lake Province. The problem was indicated in the first paragraph under this heading in the 1933 report. Experience, observation and trial incline us to consider that in many parts of the Lake Province the family unit should be twenty acres in extent, of which ten would be under cultivation. If possible, no family should have to go further than one mile for water, the holdings should be laid out so that the best use is made of the country, and narrow contour breaks of bush should be left as a counter to wind and water erosion : they would serve as cattle lanes. Unguided and without administration native people have rarely undertaken development of a really permanent nature, and the idea that almost the only heritage of the baby African boy is the African bush surely to-day must be amended. What is not yet fully realized is the pace at which the best of the African tribes are advancing. One has only to visualize the consequences of a planned country-side—in trade, in welfare, in the establishment of native tradesmen and the use of imported hardware of all descriptions—and to study the material and land available for this to acquire enthusiasm for the project. Action somewhat similar in nature was taken in England centuries ago, and settlement is not to-day permitted to take shape in any haphazard manner. In the circle report for the Lake and Western provinces it will be noted that settlement has begun, but it is realized that it must be orderly, and that without water supplies (either river, well, or even piped) its scope must be restricted, and unoccupied fly bush remain uncomfortably near settlements in which it is essential that cattle be kept. The first stage is not difficult, the second stage of expansion will require more in the way of capital expenditure.

It is realized that progress in native agriculture in the main will come about by the will of the people, and that it is not possible rapidly to attain to a high standard of *efficiency* with a mass population. We must progress in ways such as will not create avoidable administrative problems and we should reach a position only after safely consolidating what has gone before. The temptation to make a sweeping change is always there; the clean sweep method is suitable with the details but in the larger issues we believe that *festina lente* is the right policy. People, therefore, must be content to see improvements which are applied by the cultivator himself coming along gradually in little bits as it were. Where, however, by intervention in the stream of production we can effect improvement then rapid changes at that point are to be expected. Thus the art of agriculture will progress slowly and the make-up of the products change much more rapidly. It is important never to lose sight of primary issues such as anti-erosion, lay-out, the use of manure and compost, the use of livestock, the development of communal and individual water-supplies both for consumption and irrigation, the food store both of harvested grain, stock feed and of underground tubers and roots, roads, and to regard as details such things as grading, improvement of seed, crop realization, etc., which may be dealt with *en bloc*. As agriculture is a broad subject, broad as life itself, it is possible on the average to advance only as the people are induced to advance. In specialist corners of it, particularly if they are new, it is possible to forge ahead, but it is wise to guard against distortion. From distortion we have erosion, even starvation, waste of land and effort.

loss of livestock, etc. Some reflection will show that in several directions by the perhaps impatient application of scientific methods in the mass, which have been successful in achieving what the method was intended to achieve, there has followed, gradually, a series of problems possibly worse than the original one which had been solved, without assimilation, all too rapidly.

This topic is of great interest, it is introduced merely as an indication that agricultural problems are not altogether wholly agricultural.

Irrigation and Agricultural Water Supplies.

More attention has been paid to this matter during the year. The department, instructed by Government, enlisted the services of Colonel Homer, R.E., in connection with the reconnaissance of an area in the Pare District, possibly irrigable from the Ruvu River. The boundaries of the area have been ascertained approximately, soil analyses and a soil survey with an examination of the water supply are under way. In view of the number of possible projects in the Tanga Province a more detailed and extensive survey is projected for 1935. Dr. Teale and Mr. Gillman of the Geological and Railways departments respectively, have been engaged in the examination of water problems and supplies in the Northern and Tanga provinces. Information regarding a simple gear and pump using ox-traction has been secured from the South African Department of Native Affairs and circulated. This form of gear would be useful in native mixed farming areas, where supplies of water in the dry season are uncertain and available supplies frequently become somewhat remote from settlement. A programme for the development of water supplies, especially in fly areas, is urgently needed.

Pests and Diseases.

Pests.—There was an invasion of the territory on a small scale by the Red Locust (*Nomadacris septemfasciata*) at the beginning of the year. The swarms crossed the Rovuma River, coming from the south on a wide front, and penetrated as far north as the Sabaki River in Kenya. The invasion continued intermittently until the end of March, by which time every province in the territory was infested. Action was taken in many areas to reduce the infestation by the destruction of eggs and hoppers; and nature assisted, as parasites were commonly found on the egg masses and hoppers died in parts from the fungus *Empusa*. This disease also caused the destruction of a number of adults, and as a result the territory was not heavily infested towards the close of the year. In December, 1934, laying again took place but in diffuse patches over many districts in the territory, and at the same time large birds appeared in flocks, which had the effect of driving swarms about and breaking them up.

The Migratory Locust which caused damage in 1933 still persisted, but mainly as an admixture in the swarms of red locust. It is anticipated that in 1935 locust swarms will not increase in numbers and that the territory will be only lightly infested at the end of that year. The sum of £5,600 was spent on anti-locust activities, stores and equipment during the year, and at the end of the year further funds were made available for expenditure in 1935. A note on locust invasions was prepared as a sessional paper (No. 2 of 1934).

The Director attended the Pan-African Locust Conference in Pretoria in July, 1934, as representative of the East African territories. It is desired to acknowledge the very great help accorded this department by individuals and all officers in the territory, and to acknowledge the value of the reports regarding locust activities which are sent in regularly. These are transmitted to

research workers in Africa and elsewhere through the Imperial Institute of Entomology, and their utility has frequently been referred to.

Cotton pests of the chewing type, with the exception of locusts, were much less in evidence during 1934 than ever before recorded, but prolongation of the rains in many cotton districts produced conditions suitable to jassids, aphis and several plant bugs.

Coffee pests have received considerable attention: they seem to increase in numbers and variety; weather conditions are frequently determining factors affecting their appearance and activity, and many of them come under control in due course. The interesting and informative report of the Entomologist, Mr. A. H. Ritchie (Annexure IV), shows clearly with what hosts of pests the coffee planter has to contend. Nevertheless it is considered that good, sound cultural methods will go far to protect the crop and the trees in many cases. At the end of the year the Entomologist proceeded to Bukoba; he will be stationed at Nyakato. It is thought that the work he is to initiate there will lead to a better understanding of the natural control of coffee pests, which should prove of value throughout East Africa.

Sisal weevil has increased in numbers in the Tanga Province. As this pest has exhibited waves of increased incidence in the past and competent observers of experience consider that the present situation is no worse than it has been before the department for the present is satisfied that in the application of ordinary principles of field sanitation there lies the chief economical check to the weevil. The Assistant Entomologist visited a number of estates and advice has been circulated which does not differ in principle from that given heretofore by the department, but the extension of the area in Tanga under sisal, compared with the old sisal areas unregenerated and those left as bush, may be a factor the effect of which is not yet realized.

Rodents.—Wherever long grass is burnt too early in the season, rodents which normally live in the bush seek shelter in cotton fields, and thus there is a "rat invasion." This occurred in the Rufiji District, and will recur at intervals in other parts of the territory. It is to be noted that for two years there has been no serious rodent damage reported from the Lindi Province, or the Morogoro and Kilosa districts; but at any time due to various causes, there may be a concentration of rodents in a cropped area, with the consequent demand for a "campaign."

Diseases.—Root diseases of perennial crops (*Armillaria* sp.) have been studied and the number of living plants, trees and shrubs susceptible to the disease is constantly being added to. Distribution is general over 3,000 feet altitude. In cold districts a disease of coffee, tea, etc. (possibly Stilbum), has done damage and mosaic has occurred in tobacco and sugar cane. Work on cassava, which was originally free from leaf curl, indicates that vegetative propagation is unlikely permanently to ensure freedom from the disease, and seedling types are being sought. Amani workers are interested in this problem. The report of the Mycologist is attached (Annexure VI).

Experiment Stations.

Reports from experimental stations are attached (Annexures VIII to XII). The rainfall conditions of all these stations are given in Appendix IV. Collaboration by the Amani staff with the scientific staff and the officers working on research and experimental stations is increasing. The following summaries of experimental work and programme are given:—

NORTHERN PROVINCE.

Coffee Research Station.—This station is nearing completion. The building of the essential houses and laboratory was delayed by the fact that public tenders were called for, and in the end the Department of Public Works found it necessary to undertake their erection.

However, the lay-out of the station is fairly well forward and staff, with the exception of the Chemist (Mr. H. B. Stent) whose laboratory is not yet ready, is on the station. The Chemist worked throughout the year at Amani, to which institution the department is indebted in this and many other matters during the year.

Growth measurements and records of cherry yields of some ten thousand individual coffee trees of different varieties and ages and growing under various conditions of soil and climate were carried out on European and native coffee plantations to obtain that knowledge of the coffee plant which is fundamental to successful experimentation and for the selection of mother trees for future propagation. Work has also been started there on the means by which coffee can be propagated vegetatively on a commercial scale. A collection of species and varieties of coffee and of shade trees has been started.

A building at the Nyakato School, Bukoba, has been fitted up as a branch of the coffee research station for entomological work. As two-thirds of the coffee crop of the territory is grown in the Bukoba District, and as it has been amply proven that by following departmental advice there has been an increase in coffee output and a decrease in pest damaged coffee, the utility of entomological investigation on the spot is recognized. Furthermore, as so many coffee diseases in Bukoba are kept in check by nature, a study of these in the district is well worth while for other coffee areas in East Africa.

TANGA PROVINCE.

The Mlingano Sisal Research and Experimental Station.—Towards the end of the year possession of the land was secured and clearing was begun. The station should be equipped in 1935. A programme of work has been drawn up. Amani workers will be very closely identified with the work on this station, which has been sited to meet their requirements. Interesting observations on sisal will be found in the report of the Morogoro Experimental Station.

EASTERN PROVINCE.

Morogoro Experimental Station.—This station deals with cotton, sorghums, maize, citrus, animal husbandry and mixed farming generally. Nursery work is an important feature; the lists of planting material received and distributed (annexed to the full report of the station, which is attached) indicates the need for this service. Cotton selection work has been continued, and some very promising isolations have been made—and some tested—showing staple length, quality, pest and disease resistance superior to the parent ordinary district cotton. Seed and lint of a type with especially long staple and peculiar characteristics have been sent to the Empire Cotton Growing Corporation's Cotton Station in Trinidad for identification. Local sorghums have been classified and selections made in an endeavour to obtain earlier maturing hard grained types. Maize and cover crop trials were carried out and an experiment with sisal was conducted which is of interest and importance to sisal growers. The dairy herd has been maintained despite the occasional presence of "tsetse." Stall feeding is followed in the dry season and ploughing is carried out. Improvement in local stock has occurred through the distribution of young bulls from the station. An examination of the Indore method of

compost making has been made and it is intended to start a compost factory utilizing township waste as well as animal and crop débris from the farm.

As indicated in the report of the Senior Agricultural Assistant (see Annexure VII), the coffee trees on the station which were budded and grafted have borne a good crop of fair quality. This work has been of assistance to the officer in charge of the Coffee Research Station, Moshi.

The generous assistance of the Empire Cotton Growing Corporation will enable the work of the Morogoro Experimental Station (as also that of Ukiriguru, Lubaga and Mpanganya, dealt with below) to be intensified and extended. Under the scheme submitted to the Corporation a large area of land (forty square miles) has been reserved near Kingolwira, fourteen miles from Morogoro, for the purpose of extending the work of the Morogoro Experimental Station, especially in regard to cotton and the mass supply of seed of improved cotton strains, also for the settlement of selected natives on holdings under supervision. When the bush has been cleared to free the land from fly cattle will be introduced and mixed farming by natives developed. Approximately 150 acres of land have been cleared for planting in 1935, a small ginnery has been built to deal with the cotton selections and varieties, and a start has been made on building one of the two houses intended for the European staff.

Mpanganya Experimental Station.—This station previously dealt with cotton, rice and sorghums, but its activities were curtailed by economic circumstances. The grant made by the Empire Cotton Growing Corporation has enabled the station to be re-opened and the property reconditioned. An agricultural officer was posted there towards the end of the year.

LAKE PROVINCE.

Lubaga Experimental Station.—An area of thirty acres of this station is devoted to experimentation, the remainder being a native authority and seed and multiplication farm. The main activities of this station near Shinyanga are with cotton and groundnuts. The station serves a semi-arid area, and the most important feature of the work is to select from the U/4 and U/4/4/2 Barberton cottons—strains which are even more resistant to drought and jassid attack. Seed multiplication of U/4/4/2 cotton was also made to meet the district's needs; supplies of seed of groundnuts and several varieties of beans were also increased. The net profit handed over to the native treasury from the native authority seed farm amounted to over £150; the average profit for the past four years is over £120 per annum. Many of the experiments suffered from the rainfall conditions which, even for the Shinyanga District, were poor for the second successive year.

Ukiriguru Experimental Station.—Experimental work carried out during the year on this important station, which serves the densely-populated lake-shore area of the Mwanza District, included the usual selections of cotton; trials of mass selected against ordinary district cotton; examination and selection of sorghums and groundnuts; inhibition of rosette disease of groundnuts; trials of bulrush millets; residual value of farmyard manure and of green manuring; manuring of cotton and pennisetum; rice trials; and trials of early maturing varieties of pigeon peas from India. Seedlings of cassava were raised, some of which show a fair degree of resistance to "wilt disease." The matter of stock feed is of great importance to the Lake Province generally. At Ukiriguru edible canna has proved its worth; little promise has been shown by any of the grasses tried, Finger grass and Kuruman A. being the best.

Samples of heads of broom corn were sent to England and received favourable comment; plant selection is being undertaken to establish a more uniform type of head.

IRINGA PROVINCE.

Iheme Experimental Station.—The aims of this station were given in the last annual report. Briefly they are primarily tobacco experimentation, mixed farming and fruit culture; and gradual development into a general agricultural training centre is intended. A ploughing school already exists. During the year building of fire-curing barns, conditioning cellars and a house for training apprentices was undertaken. A modified Indore system of compost making has proved successful. The land is "raw" and requires working up before it can be properly used, so that the significance of experiments will be masked for a year or two. Pure line selection of tobacco varieties has provided better seed to planters. In addition to tobacco, work is carried out on peas and wheat. Reafforestation has been carried out; this has proved a demonstration that is being taken up by planters on their own farms. The officer in charge, Mr. C. J. McGregor, District Agricultural Officer, spent the major portion of the year in a study of tobacco in the United States of America. The generous assistance of the Carnegie Trustees made this study leave possible.

PUBLICATIONS.

The following pamphlets and leaflets were published by the department during 1934:—

Pamphlet No. 12: "Memorandum on Locust Destruction," by J. G. M. King, District Agricultural Officer.

Pamphlet No. 13: "Coffee Grafting and Budding," by T. H. Marshall, Senior Agricultural Assistant.

Mycological Leaflet No. 6: "Maradhi ya Mizizi ya Mimea na Jinsi ya Kuyazuia," by Dr. G. B. Wallace, Mycologist.

Mycological Leaflet No. 15: "Diseases of Tobacco," by Dr. G. B. Wallace, Mycologist.

Mycological Leaflet No. 16: "Report on a Survey of Plant Diseases in the Iringa Province in June, 1934," by Dr. G. B. Wallace, Mycologist.

Entomological Circular No. 12: "Mizinga;" "Kwa Nini Kuwa Vizuri Kuwawekea Nyuki Mizinga," by W. V. Harris, Assistant Entomologist.

Other leaflets prepared during the year are as follows:—

Sessional Paper No. 2 of 1934: "Report on Locust Invasions in Tanganyika," by E. Harrison, Director of Agriculture.

"Report on the Activities of the Coffee Board," by E. Harrison, Director of Agriculture.

"Infection of Axillary and Sucker Shoots of Sorghum," by Dr. G. B. Wallace, Mycologist.

"The Colorado Beetle," by A. H. Ritchie, Entomologist.

"Plant Nematodes," by A. H. Ritchie, Entomologist.

"Memorandum on Flame-Guns," by A. H. Ritchie, Entomologist.

"Plant Nematodes and Virus Transmission," by A. H. Ritchie, Entomologist.

"The Pigeon Pea," by W. V. Harris, Assistant Entomologist.

"Beeswax," by W. V. Harris, Assistant Entomologist.

"Cotton Notes," by E. Harrison, Director of Agriculture.

"Local Notes on Soil Erosion," by E. Harrison, Director of Agriculture.

"Gum Production in the Sudan and Shinyanga—a Comparison," by H. Marsland, District Agricultural Officer.

"The Production of Jagree with Special Reference to Kilosa District," by N. R. Fuggles-Couchman, District Agricultural Officer.

Legislation was passed dealing with the restriction of tea planting.

The Cotton Advisory Board sat in Dar es Salaam once during the year; the Coffee Advisory Board met in Moshi four times; meetings with the Sisal Association and the Sisal Board were held in Tanga three times during the year. The advice given by these boards has proven valuable to the respective industries, and members without exception have willingly given their time and their knowledge, for which service the grateful thanks of the department are due. A résumé of the work done by the Coffee Board was made and laid on the table at the Legislative Council meeting in October. A meeting of the Board of Governors of the Coffee Research and Experimental Station was held at Lyamungu and the approved proposals were published; the report of the Coffee Board regarding its further development was published and circulated. The Director with the Chief Scientific Officer visited Nairobi to consult with the Kenya Coffee Board executive, and thereafter certain members of the Tanganyika Coffee Board and the Senior Agricultural Officer, Northern Province, met members of the Kenya Coffee Board in joint session.

The Director of the East African Agricultural Research Station, Amani, is a member of the governing or managing bodies of the Coffee and Sisal Experiment stations, and in this way collaboration in scientific work is assisted and overlap is avoided. Kenya will send a member to the meetings of the managing body of the Sisal Experiment Station. It is hoped that in the course of future development it will be possible either to identify Amani still more closely with stations established for perennial crops or alternatively to identify such stations more closely with Amani; it is immaterial either way provided the work is urged more forward.

The heads of the departments of Forestry, Veterinary Services and Agriculture met again in conference to discuss matters of common interest and to proffer considered advice on them.

The organization of the department remains much the same, but there have been considerable additions to its activities and responsibilities which show little sign of having reached finality.

The establishment of the coffee station has thrown a great deal of work on head office, which could not have been undertaken by the people on the station; the establishment of the sisal station has been given attention and much more will have to be done in 1935. The grants from the Empire Cotton Growing Corporation have enabled the department considerably to extend its work on cotton, not only experimentally but practically, and at the same time have put the department in the way of undertaking some organized native settlement. The great value of the grants made by the Empire Cotton Growing Corporation, not only to both this department and the cotton industry of the territory but also as regards land development and the clearing out of tsetse by means of settlement, will become apparent within a few years. The staff of the department is also acting in the work of crop realization with tobacco in Songea and Biharamulo and coffee in Tukuyu. The commercial work with tobacco and accounting therefor is being undertaken by the department without any additional provision having been made, and this work is becoming increasingly onerous. Throughout the territory one finds the agricultural officer and the staff of the department becoming more and more engaged; the scope and nature of their duties has sensibly increased. There is very little doubt but that the staff in many areas is becoming heavily worked.

Despite the diversity of its duties the staff accomplished a great deal of sound work during the year, most of it in the field. The Director travelled

over 10,000 miles by light plane in East Africa during the year. Headquarters' staff has been almost continuously hard-pressed, and thanks are due to all officers for their devotion and spirit of helpfulness throughout the year.

Mr. W. E. Pownall, Chief Clerk of the Department for fourteen years, was awarded the M.B.E. for his valuable, long and faithful services to Government, a recognition which gave satisfaction to all officers of the department.

I would like to record my thanks to Mr. L. A. W. Vickers-Haviland of the Administration for the help he accorded me during a period of two and a half years spent in the headquarters office. Provision has been made in the 1935 estimates for the post of Deputy Director, which will be filled by the promotion of Mr. A. J. Wakefield, Senior Agricultural Officer of this department.

It is a pleasure to write appreciatively of the spirit which pervades the Administration and staff in many districts and provinces, which all tends towards the betterment of agriculture and the prosperity of the territory, and also to record thanks for the way in which officers of other departments are helping agricultural staff in the field to overtake their duties. Gradually effect is being given to the expressed policy of Government as regards agricultural development practically throughout the territory, the enthusiasm of many officers is most gratefully recorded.

COTTON. NOTES ON CHIEF EXPORT CROPS.

In the last report reference was made to action taken in consultation with the cotton industry to put it on a more stable footing, in that the value of seed-cotton at a market could more readily be determined, and that ginners were more assured of supplies from their areas as excessive lorry transport had been considerably checked. The integrity of the cost formula must be well guarded. In view of the benefits which have accrued and the fact that in no calculation is the value of cotton seed taken into account, arguments that seed distribution is costly should be disregarded as without distribution there is no cotton and *on the average* cotton seed values will cover this cost. In fact, as production increases costs must inevitably fall, and the industry should look forward to the time when it will be in a position to surrender a greater proportion of the value of lint to the grower of seed-cotton or to Government.

The British Cotton Growing Association has very generously consented to provide two ginnery inspectors to serve in the territory for a period of five years.

As regards ginneries, the mistake of multiplying this essential equipment by an increase in the number of ginnery sites must constantly be guarded against. Ginneries in the territory are only small models of what a ginnery should be, and many of them are poorly equipped. Reasonable expansion should be allowed but only on an increase in crop which has been maintained for a period long enough to enable one to consider the increase permanent. Better to suffer a temporary embarrassment of quantities of seed-cotton than to multiply the numbers of ginnery sites without forethought and experience.

The economies which have been effected in buying, by reduction of the number of buyers operating in any cotton market, checked as to prices by the price scale and constantly supervised regarding weighing and paying out, is ultimately bound to secure to the grower the fullest price properly paid.

It is again possible to report an increase in the export of cotton lint during the year, constituting a new record for the territory, 5,645 tons equivalent to 31,612 bales being exported as against 5,075 tons or 28,420 bales in 1933.

Actual production for the season is estimated from seed-cotton returns at 38,000 bales, an appreciable part of which is necessarily carried over into 1935. It is gratifying to be able to record this increase, particularly as the crop grown to the east of the Rift Valley was almost a failure.

Production in the Lake Province was very greatly increased whilst in the Eastern Province, which at least should equal the Lake Province in outturn, the crop fell far short of expectations, many plots producing little or nothing. Similarly in Lindi Province, an anticipated production of 2,000 bales was reduced to an actual of under 700. Showery, dull weather up to August was the primary cause of loss of crop.

Estate production showed a further increase but still not one commensurate with both the very greatly extended areas planted by non-natives and the opportunities the crop provides. Speaking conservatively, the territory missed making a spectacular leap in cotton production (it was estimated at over 30,000 bales), yet given average conditions in the Eastern, Lindi and Tanga provinces over 40,000 bales would have been secured; and for 1935 we are faced with the problem of growing 50,000 bales and enduring locusts at the same time.

Owing to the poor quality and smallness of the crop in the areas to the east of the Rift Valley seed supplies have had to be augmented, over 500 tons of seed being moved from the Lake Province to Lindi, Kilwa, the Rufiji and the Eastern Province generally. In addition, 500 tons were moved into the Western Province in connection with the establishment of the crop in that province. This has made large inroads on the moneys available from the Cotton Tax.

It is the hope and desire of this department to see cotton production forge ahead, because of the vast areas of the territory in which at present it must be the main cash crop.

As this report is compiled prior to the completion of the season's ginning it is not possible to give the completed figures for lint production, but in the following table approximate figures for 1934 are given based on the seed-cotton production figures for the year, which are also included :—

PROVINCE	Season's production of Lint in Pounds				Seed-cotton in Pounds, 1934
	1931	1932	1933	*1934 approx.	
Eastern	1,566,834	3 405,945	5,645,278	4,210,665	13,582,793
Lake	2,805,361	3,098,877	6,035,808	10,326,539	33,311,417
Lindi	63,058	16,548	391,120	241,844	780,145
Tanga & Northern	105,378	694,532	261,627	456,013	1,471,011
Total ...	4,540,631	7,215,902	12,333,833	15,235,061	49,145,366
Bales ...	11,351	18,039	30,834	38,087	—

*Based on 31 per cent. extraction.

Non-native production for 1934 is estimated at 4,540 bales (of 400lb. each), about 12 per cent. of the total production as compared with 11 per cent. in 1933.

The following are the figures of non-native production in the various provinces :—

Eastern Province	3,746 bales.
Northern and Tanga provinces	720 ,,
Lindi Province	39 ,,
Other areas	35 ,,
Total ...	4,540 bales.

The sales of seed-cotton by natives during the 1934 season are shown in the following table :—

PROVINCE	Seed-Cotton (Native) in Pounds				Value received by Grower
	1st quality	2nd quality	3rd quality	Total	
					Shs.
Eastern	3,175,627	1,491,814	4,082,407	8,749,848	724,282
Lindi	310,323	151,327	268,421	730,071	57,582
Northern and Tanga	343,253	40,722	157,436	541,411	45,573
Lake	28,177,721	82,651	4,982,902	33,243,274	3,805,676
Western	3,779	9,678	9,709	23,166	1,947

The range of prices paid in the various provinces shown in shillings and cents of a shilling per 100lb. of seed-cotton is given in the following table :—

PROVINCE	1st Quality		2nd Quality		3rd Quality	
	Max.	Min.	Max.	Min.	Max.	Min.
Eastern ...	11/81	8/18	9/54	6/36	7/72	4/09
Lake ...	10/90	10/45	—	—	6/81	6/36
Tanga ...	10/45	9/54	8/63	7/72	6/36	5/45
Northern ...	10/00	8/18	8/18	6/36	5/90	4/09
Lindi ...	10/45	9/09	8/63	7/72	6/36	5/45
Western ...	10/90	10/45	8/63	8/18	6/81	6/36

First and third qualities only are purchased in the Lake Province.

SISAL.

An increase in export again falls to be recorded for this valuable crop, a total of 72,510 tons having been sent out of the country plus 754 tons of manufactured rope and twine. The official estimate was 70,300 tons. The rumours current in the first quarter of the year as to a curtailment of output in the second half of the year were discounted locally, and in point of fact more sisal was exported during the second half of the year than during the first. The department cannot subscribe to the view that the amount exported in 1935 will be less than in 1934 but rather that it will be more, for the simple reason that new plantations are being cut, the capacity of machinery is being increased and small estates are being linked up with large ones. Prices during the year were only fair and fell heavily at one time, recovering somewhat towards the close of the year. With a small steady increase in demand which must come about as new uses for the fibre are discovered and put into commercial practice, there is little fear of over-production in this territory at any rate for some years.

The sisal tax of Sh. 1/- per ton of sisal and tow exported, levied on both manufactured and unmanufactured sisal, was applied on 12th May, 1934, and

collections to the end of the year amounted to £2,472. Thus the estimate of £3,500 for a full year would have been realized. The proceeds of this tax are disbursed as follows :—

(a) To the maintenance of the Tanganyika Sisal Growers' Association, and the travelling of the members of the Sisal Tax Committee;

(b) To part of the cost of staff, upkeep and interest on capital for the Sisal Experimental Station, Mlingano; towards this, the Kenya Sisal Cess Committee contributes £200 per annum and the Colonial Development Fund is responsible for £1,110 per annum for five years; and

(c) To a contribution towards the cost of research on sisal fibre and its uses in Great Britain. The Kenya Cess Committee and the Colonial Development Fund also contribute to this joint endeavour. The funds are administered by a Board of Trustees in London and the British Empire Producers' Organization acts as secretaries to the trustees.

Liaison is maintained with Kenya by means of a small joint committee, so that the requirements of the sisal industry in East Africa, as regards research and so forth, can be approached co-operatively and with balance as regards the proportion of contribution. It would appear desirable that the sisal producers in East Africa form one association as soon as convenient, since a joint association would carry more weight and would help to eliminate delays, particularly if dates for meetings could be fixed twelve months ahead and adhered to.

The outlook for the industry at the close of the year was a little more cheerful, its importance in the economics of the territory is fully recognized. It is at present our mainstay as it puts into local circulation far more cash than any other product, and does it with regularity monthly throughout the year; a fair rise in price, great enough to enable producers to afford a small increase in the wage rate, would be more than welcome.

The crop for 1934 was valued at £847,562 plus an export of manufactured ropes and twines to a value of £18,458, a total of £866,020.

The following are the figures showing production in the various areas for the last three years :—

	1932 Tons		1933 Tons		1934 Tons
Tanga Province	40,487	...	45,329	...	40,614
Morogoro-Kilosa-Dar es Salaam ...	11,052	...	13,964	...	18,650
Lindi-Mikindani	7,240	...	7,817	...	8,359
Northern Province	1,775	...	2,490	...	4,887
	60,554	...	69,600	...	72,510

COFFEE.

The coffee exported in 1934 constitutes a record for the territory, 14,766 tons having been exported as compared with last year's record export of 12,718 tons; the 1934 crop was valued at £495,237 f.o.b.

The increase in production is mainly due to the continued increase in output from Bukoba; in addition, the valuable crop from the southern highlands reached 270 tons. In the Northern Province also the output is steadier, due to the greater care taken with plantations. It is also to be remarked that Tanganyika coffees show a tendency to recover their values in the market. This may perhaps be traced to the influence on quality exercised by the better treatment of the coffee plantations by all races. The native arabica crop in Kilimanjaro showed an increased output of forty per cent. It would be as well to mention what has happened in the various areas :

Bukoba.—There has been but little additional planting during the past four years, much of the increase in output being due to improvement in the handling of existing plantings. Infestation by *Stephanoderes* beetle which causes considerable loss in weight in coffee has been considerably reduced by means of sanitation at the end of the season when all *buni* and fallen coffee is removed from the plantation and burnt, thus disposing of material in which the beetle breeds and carries over. The grader considers that this action has added over 1,000 tons to the production by checking loss in weight. The regeneration of the trees by pruning has also assisted. More attention is being paid to mulching, but much remains to be done in this direction. Exports from this part of the territory will be augmented when the young crop of Bugufi develops, and even in Biharamulo, following trials made in certain spots, there may be a significant production in the future. We anticipate a crop in 1935 equally as big as the 1934 crop, which amounted to 10,209 tons, but with a greater proportion of robusta.

There is no shadow of doubt to-day that the combined activities of the administration, native authorities and this department, coupled with the steady prices secured for the crop aided by the grading scheme, has resulted in appreciable progress, the crop produced in 1934 exceeding the crop of 1930 by nearly 3,000 tons.

There are, however, serious conditions still to be overcome: there is still much room for improvement in the preparation of the coffee, there are a number of young men who are not yet developing holdings of their own and there is a tendency for coffee to be planted without the essential banana interplanting to provide mulch, shade and protection. Further progress must be made, which should be stimulated by the work of the coffee school at Nyakato. The export of Bukoba coffees to the United States has been a feature and the increasing interest from Canada is marked.

Northern Province.—The effects of more careful cultural methods, more sensible irrigation methods, the spraying of the coffee bushes to combat leaf fall, *Antestia* and so forth, the destruction of over two million wild host plants of the coffee borer, the increasing practice of terracing, pitting and contour trenching, and the gradually improving practice of coffee culture, are quickly having an effect on the appearance of the coffee trees, and the outturn from this province should improve.

In Oldeani it is unfortunate that planters do not all practise sound coffee culture where it is almost as easy to do what is right as what is wrong.

The Arusha and Babati areas suffered most severely from drought which depressed production by fifty per cent. The bean was also abnormally light and some estates lost a fairly heavy proportion of their trees.

The outturn of coffee from this province is steadily increasing, and may be expected to increase: in 1934 the exports were only 400 tons lower than the record of the previous year. The Coffee Research and Experimental Station should be in a position in a few years to point the way to a sounder cultural and planting programme than we have as yet evolved.

Tanga Province.—The condition of the coffee plantations in the Lushoto District has improved considerably.

Iringa Province.—Apart from extensions in Mbosi and Mbeya in non-native plantations with possibly a slight increase in Igololo, it is anticipated that native coffee growers in the Rungwe District will increase in numbers, and as the system which natives can follow is standardized there may be scope for a resumption of non-native coffee planting in the Tukuyu District.

The figures for production in the chief coffee areas in 1934 and the two previous years were :—

AREA	1932 Cwts.	1933 Cwts.	1934 Cwts.
Bukoba	142,143	158,440	204,191
Northern Province	77,360	92,180	84,140
Usambara District	4,780	3,320	3,440
Iringa Province and other areas ...	2,957	3,840	3,549

The figures of production of native and non-native or estate coffee for export in 1932, 1933 and 1934 are as follows :—

	1932 Cwts.	1933 Cwts.	1934 Cwts.
Estate production	63,097	73,460	58,649
Native production	164,143	180,900	236,671
	227,240	254,360	295,320

The total value of the 1934 crop was £495,237 as compared with £429,523 for the previous year.

The following are the figures for grading and inspection at Bukoba for the year :—

No. of bags of 200lb.	Graded			Inspected		Total passed for Export
	G.A.Q.	F.A.Q.	Triage	Passed	Rejected	
Arabica	648	35,530	—	887	9,974	37,065
Robusta	58	77,803	1,108	275	16,713	79,244
					Total ...	116,309

TOBACCO.

The production of fire-cured tobacco shows a considerable increase over 1933, particularly in the Songea and Biharamulo districts, whilst there was a smaller increase to record from the Iringa District. Elsewhere in the territory sporadic attempts are made to produce fire-cured tobacco mainly for the local market whilst prices are good. The total production of fire-cured virginian tobacco amounted to approximately 245,000lb. as compared with 90,000lb. in 1933. In addition there is a considerable production of native roll tobacco. The value of manufactured tobacco exported from the territory in 1934 was over £66,000.

The local market at the end of the year was saturated with a carry-over, and manufacturers had also secured considerable supplies in Uganda, where the crop is in excess of local requirements. Whilst this market is of value in stimulating interest in tobacco growing, it is to the export market that producers will have to turn if they desire to increase their output and realize it.

The department restricts its direct work on tobacco to the districts of Songea, Biharamulo and Iringa, as these areas require a high-priced crop and have few alternatives. It will be necessary to exercise some control over the expansion of production by individuals in due course, and a licensing system such as is in force in Nyasaland will become increasingly necessary as production expands. Whilst planters in some instances have been able to make

contracts locally for the supply of tobacco to the local market, the department has had to be content with selling locally only a proportion of the production from the two native areas, and it is intended to make a strong effort to establish a grade or grades in Liverpool where fire-cured tobacco appears to be saleable at fair prices.

As regards turkish tobacco, production is stationary at about 7,000lb., but the British American Tobacco Company has recently taken an interest in this crop and may be relied on to foster production within reason.

GROUNDNUTS.

There was a heavy fall of over 11,000 tons in total exports below that of last year's record, only 8,036 tons being exported. Whilst Lindi Province was able to record an increase the output from the Lake and Western provinces was heavily down. The long awaited groundnut crop of Singida and Mkalama was again not in evidence.

The real cause of the setback was drought at a critical time, which prevented the setting and filling of the nut. Furthermore, the overseas prices fell to such a figure that the prices offered to producers were very low, and in view of the impending shortage of food due to the weather conditions natives preferred to eat rather than to sell. Prices recovered towards the end of the year. A very much increased acreage was planted to the crop, and many natives finding that yields would be light decided to replant part of their groundnut acreage with late cotton, which fortunately gave a yield.

COPRA.

The outturn of this commodity varies mainly with the price, which in 1934 was very low so that production was affected. As the coconut grows on the coast and as coastal natives are not particularly industrious the deciding factors in the output are the price and the inclinations of the people. The following table sets out the exports for the past three years :—

	1932 Tons		1933 Tons		1934 Tons
Tanga-Pangani	1,573	...	2,283	...	1,510
Kilwa-Lindi-Mikindani	887	...	467	...	439
Mafia-Dar es Salaam-Bagamoyo-Rufiji ...	4,805	...	5,407	...	3,781
	7,265	...	8,157	...	5,730

SESAME.

The cultivation of this crop is now mainly centred in the Lindi Province, other parts of the territory having practically given up its culture.

The export figures for the crop for the past three years are as follows :—

	1932 Tons		1933 Tons		1934 Tons
Lindi Province	3,970	...	4,085	...	3,606
Other areas	841	...	356	...	134
	4,811	...	4,441	...	3,740

GRAINS.

There has been a welcome revival in the trade in grains of every description. The maize crop of the Northern Province was excellent and a fair tonnage was exported. Lindi too increased its outturn of millet, and the rice crop of the territory was up to average.

The following are the export figures for the three main grain crops :—

	1932 Tons		1933 Tons		1934 Tons
Rice	5,385	...	6,293	...	6,259
Millet	3,529	...	2,845	...	2,735
Maize	2,823	...	868	...	2,901
	11,737	...	10,006	...	11,895

OTHER CROPS AND PRODUCTS.

Beeswax.—Production fell due to weakness of bee colonies at the beginning of the year following droughty conditions. Consultations regarding the need for inspection, and grading possibly, were undertaken. The problem was still under consideration at the end of the year.

Gums.—A record production of 1,124 tons is to be recorded; the output was 1,015 tons in 1933. The status and quality of this commodity requires consideration and action is contemplated.

Kapok.—This permanent crop is mainly confined to the Tanga Province; plantings also occur in the Eastern Province. It has suffered severely from the two successive years of drought, and exports show an appreciable drop.

Citrus.—There is no particular interest taken in this product; the department forwarded its usual consignments to India and Great Britain. A private individual collected and exported over 100 cases from Muhesa to London, but the consignment lay for five days after despatch from Muhesa in the sheds in Tanga, which rather affected the condition of the fruit. The reports from Bombay and London are fairly good. The department is sanguine that a grape-fruit industry is a probable development.

Tea.—Estates are established in the Usambaras, Mufindi and Rungwe areas of the territory. A small quantity of leaf of fair quality has been harvested and marketed. Restriction proposals were adopted and applied by legislation. Briefly, the present planted acreage in the territory may be permitted to expand by 2,900 acres by *1938*. It is expected that a good proportion of the production will by that time be consumed locally. It is hoped that an Eastern African tea association will be formed to deal with the many problems which are bound to arise when a crop comes under control, and in order that the local market for tea may be fully developed.

Details of Assistance and Progress.

NORTH-EASTERN CIRCLE.

Northern Province-Tanga Province.—The staff of this circle consists of a senior agricultural officer stationed at Moshi ; a district agricultural officer for each group of districts, viz. : Arusha and Mbulu ; Moshi ; Lushoto, Korogwe and Pares; Tanga, Handeni and Pangani. In addition, two agricultural assistants are posted on Kilimanjaro. An agricultural assistant has been posted to the Pares and a cotton supervisor to Handeni. The Entomologist continued to be stationed at Moshi until the end of the year, and the Mycologist transferred his headquarters from Morogoro to the Coffee Research Station in December; the District Agricultural Officer (Coffee) was also transferred to this station. A district agricultural officer with an agricultural assistant were appointed to the new sisal experimental station at Mlingano near Tanga.

Climatic conditions were again unfavourable, and for the second successive year the Northern Province suffered from drought especially in the Arusha District; on Kilimanjaro rainfall conditions were somewhat better. In the Tanga Province there was early drought and the rains were late but continued throughout the first few months of the normally dry season with disastrous results to the cotton crop. Only in Handeni was there any serious famine. Locusts occurred in both provinces but more seriously in the Tanga Province.

With the exception of the Arusha District and the newly developed Oldeani and Babati areas of the Mbulu District the coffee crop was good; a large increase occurred in native production. The output of sisal was down in the Tanga Province mainly due to climatic conditions; production in the Northern Province was doubled. Maize, especially under European management, showed a large increase in production. Much activity was also seen with non-native development of annual crops, notably cotton. Native cotton planting in the Tanga Province was increased but as elsewhere east of the Rift Wall the prolongation of the heavy rains masked the real effort that had been made.

A more detailed account of the agricultural work and activities in the Northern and Tanga provinces will be found in the report of the Senior Agricultural Officer which is presented as an annexure to the report.

NORTH-WESTERN CIRCLE.

Lake Province-Western Province.—This extensive circle has the largest and in parts the densest population in the territory. The staff consists of a senior agricultural officer stationed in Mwanza; a district agricultural officer, a senior agricultural assistant and two agricultural assistants at Bukoba; one district agricultural officer at Mwanza, and a district agricultural officer for each of the Maswa, Shinyanga, Biharamulo, Tabora and Kigoma areas. In addition, agricultural assistants are stationed in the Bugufi area and to the Ukiriguru and Lubaga experimental stations. The Agricultural Lecturer is in charge of the Nyakato Agricultural Training School.

Weather conditions were again more favourable in the Lake Province than elsewhere in the territory; nevertheless, severe mid-season drought was experienced which seriously reduced the yields of the groundnut and grain crops. The more drought resistant cotton crop stood up well to the dry conditions and a phenomenal increase in production is to be recorded : the output was 26,000 bales of cotton as compared with the previous largest production of 15,000 bales in 1933. The Bukwimba District recovered its position as one of the leading cotton producing areas, while Maswa maintained its previous high level. Mwanza also achieved a new record in cotton production. In the semi-arid district of Shinyanga considerable progress has been made with the development of the U/4/4/2 type of cotton.

The Senior Agricultural Officer refers to the enthusiastic work of development carried out by the Provincial Commissioner and his officers in the Western Province. This area was severely hit by the effects of drought. Although the groundnut crop was practically a failure, less than half the crop being harvested, and the price was almost as low as that for cereals, the importance of this crop in native agriculture has been stressed. It is trusted that natives will react fully to the advice given, the price at the end of the year being as good as one could expect. This is a good illustration of the importance of *consistent* planting of the various crops annually as opposed to the variable planting depending on what the price was *last* season.

It is gratifying to record that although the groundnut crop was a failure the people in the Western Province had an alternative in the large areas of cassava planted to excess as an anti-locust and anti-famine food, and large tonnages of dry cassava were sent out of the province. With this in their minds the authorities have realized the need for at least one additional cash crop and have launched an energetic campaign for cotton planting directed by the Provincial Commissioner, which may serve the province well. Rice production was encouraged with excellent results.

Advance is to be recorded with the Bukoba coffee crop both in the field and at the grading sheds. The comparatively small coffee industry in Bugufi continues to progress and a satisfactory advance has been made with native-grown fire-cured tobacco in Biharamulo.

The measures taken in the Lake Province for organized and regulated marketing were again successful, it may be said that they may be regarded as one of the chief causes of the very appreciable increase in the area planted to crops that has occurred in the Lake Province with consequent benefit to producer and trader alike.

Locusts were again a serious menace, and the position towards the end of the year was not reassuring.

Reference should be made to the report of the Senior Agricultural Officer which is given as an annexure, and to the report of the Agricultural Lecturer for details of progress in the scheme of agricultural training, and of the native peasant holdings, as well as of crop production.

SOUTH-EASTERN CIRCLE.

Lindi Province.—The staff in this province consists of a senior agricultural officer at Lindi, a district agricultural officer at Lindi, one agricultural assistant at Mpapura, another at Songea, and three district foremen.

Despite climatic set-backs and the uncertainty occasioned by locusts the level of production of the previous year has been generally maintained and advance made in certain directions: the production of fire-cured tobacco has increased from 6,537kg. in 1933 to 32,608kg.; there was a record production of 1,111 tons of groundnuts against 425 tons in the previous year; sesame was only 200 tons below the record for the area; a very large increase in grain production occurred; and, considering the adverse rainfall conditions, the production of cotton was well maintained.

As with the other circles, full details will be found in the report of the Senior Agricultural Officer annexed hereto.

EASTERN PROVINCE.

In the continued absence of a circle organization the details of co-ordination and supervision of agricultural work in this province, potentially rich but—as far as the native is concerned—comparatively undeveloped, were carried out as far as time permitted from head office. District agricultural officers are stationed at Dar es Salaam, Morogoro and Kilosa. Agricultural assistants are posted to Dar es Salaam to assist the district agricultural officer there with the work of the Bagamoyo District and the Botanic Gardens at Dar es Salaam, and to the Rufiji. The District Agricultural Officer, Kilosa, served the Kiberege and Mahenge areas in addition to the Kilosa area. One district agricultural officer is in charge of the Morogoro Experimental Station and he has the assistance of a farm overseer.

The effect on the cotton crop of the abnormal prolongation of the rains caused the loss of several thousands of bales of cotton. Approximately 10,700

bales of 400lb. each were produced of which about 3,700 bales were grown by non-natives. The production of 25,000 bales *by natives* in this excellent cotton-growing province should be attained to with reasonable effort. The cultivation of one acre of cotton entails work amounting in total to a period of only three weeks per family, but the attempt is often made in a half-hearted manner and in parts is not undertaken. Famine measures were again necessary in the Bagamoyo District and in parts of the Dar es Salaam and Morogoro districts. Locusts were somewhat serious throughout this province, and a further determined effort is necessary to ensure that all native cultivators have an adequate supply of a subterranean food crop. Generally speaking, the cultivator requires a much more definite lead. The value of this is demonstrated by the better outturns consistently reported from the Kilosa District, which is the outcome of more than one season's supervision and exhortation.

The rice crop was good and there was an increase in production in most areas. The state of the coconut industry is unsatisfactory—due to low prices and consequent neglect of plantation management with the added depressing factors of drought and locust damage. The greater part of the copra is produced in the Rufiji and Mafia; in the latter island non-natives produced roughly one-sixth of the 1,900 tons exported. Despite the efforts of the administration and the department, there was practically no reaction on the part of the native inhabitants of the Rufiji to planting propaganda and but little to supervision which is necessary, if natives are to improve their lot.

Sisal production in the province has increased considerably and now surpasses the cotton crop in value.

IRINGA PROVINCE.

The province is staffed by a district agricultural officer and agricultural assistant at the Iheme Agricultural Station near Iringa, and a district agricultural officer with especial tea and coffee knowledge at Tukuyu, who also serves the Njombe, Mufindi and Mbosi areas. The latter officer is assisted by an agricultural assistant who deals mainly with the flourishing native coffee industry.

Weather conditions were generally good for the type of agriculture followed throughout the province. There was an increase in the production of European coffee at Mbosi, but, while the quality of these coffees has proved the highest attainable in the territory, yields per acre are still on the low side. This is mainly to be attributed to the planting of too large areas some years ago, resulting in uneven blocks of coffee, refills being difficult to establish. Different methods of coffee preparation were tried which indicated the superiority in quality attained to by careful shade drying; the excessive drying of parchment coffee on open cement barbecues has been too common a fault.

Tea production in the Rungwe District was more than doubled, and the Mufindi area produced its first crop (produced by seven growers) which was manufactured at the central factory. A free issue of 1,127lb. of tea seed was made to fourteen Mufindi planters. Experiments carried out demonstrated that, as in Nyasaland, "tea yellows" can be simply treated by the application of sulphur either alone or as a component of artificial manures.

The Lupa goldfields have provided a ready market for native produce previously unsaleable.

The output of European-grown fire-cured virginian tobacco was increased to 103,000lb. from 64,000lb. in 1933; the quality was somewhat better. Cutworm and red rust caused some loss. The turkish crop was the same as in

the previous year and amounted to 7,000lb. A modern flour mill was established at Dabaga which milled 120 tons of wheat. Kenya Standard is the variety most commonly grown, but variety B256 has shown up best in experimental trials. Many kinds and varieties of fruit are under trial; almonds continue to show promise; marianna plum has not proved successful as a stock for Iringa conditions.

In the drier areas of the province some difficulty has been experienced in getting the natives to plant cassava. Assistance has been given with the Malangali Central School farm; native authority demonstration farms exist in the Iringa District and near Lake Nyasa.

CENTRAL PROVINCE.

This department now maintains no staff in the province. The inhabitants are mainly pastoralists. The country is semi-arid, and the main crops are grains and groundnuts. Owing to the encroachment of fly and the consequent crowding of livestock into a smaller area, it is not anticipated that a heavy surplus of produce for export from Singida and Mkalama is a likely contingency for a year or two. The people in the Singida District are largely concerned with the cutting of wide fly barriers in the bush.

On the whole the agricultural effort in the Central Province is simple, consisting as it does of the production of foodstuffs, groundnuts and cattle; the combat of erosion and the resting of grazing country are of prime importance. These are demonstrated at and urged strongly from the Mpwapwa headquarters of the Veterinary Department, which is situated in this province, and generally the agricultural effort of the Central Province is mainly the affair of the Administration advised by the Veterinary and Agricultural departments.

E. HARRISON,
Director of Agriculture.

MOROGORO,
20th February, 1935.

Annexure I.

ANNUAL REVIEW OF THE NORTH-EASTERN CIRCLE.

Northern and Tanga Provinces.

1. *Staff.*—For the first time for some years agricultural policy and work in the Northern and the Tanga provinces was seriously interrupted and disturbed by staff changes due to the fact that no reliefs were available for those European officers proceeding on vacation leave and to the transfer of staff to the newly-formed coffee and sisal experimental stations. For some months there was but one District Agricultural Officer for the Tanga Province, and it became quite impossible to cope with the demands of those district officers enthusiastic for the economic development of their areas. In addition non-native development seeks the aid and advice of the agricultural officer in an ever increasing manner; especially are the newly settled areas in the Mbulu District in need of more assistance. It can be said that the needs of development and scope for increased production finds district officers, and planters too, so willing to run in team-harness that it becomes difficult for the agricultural officer, who has to serve more than one area and such a diversity of interests, to keep pace. Over a period of ten months one officer spent 190 nights on *safari*, others have spent over 200 nights in the year on *safari*.

2. Despite the help given by the Kilimanjaro Native Co-operative Union (who pay for four African instructors) and by native administrations who assist where possible, the native staff remains woefully below the real needs of the area. Tribute is repeatedly paid by administrative officers and others to the good services rendered by these men.

3. By arrangement with the Kenya Department of Agriculture assistance and advice has been given when requested to the planters of the Taveta area over the border near Moshi, and the District Commissioner, Voi, has been assisted as far as possible in the development of native grown cotton at Taveta.

4. *Weather and Rainfall.*—The severe drought conditions of 1933 continued well into the year under review, but when at last the long rains broke, these, although not heavy, were well distributed and especially suitable for coffee in the Moshi District; but coffee and other crops suffered severely from drought in the Arusha, Usa, Oldonyo Sambu, Rasha Rasha, Oldeani and Babati areas. Beginning late, the rains also ended late, hence the coffee crop ripened later than usual. June and even July were exceptionally wet months. These conditions pertained especially in the Tanga Province and were extremely adverse to the flowering cotton crop, also sisal production was sometimes held up owing to difficulty in drying. The rains were by no means sufficient to make up for the previous year's drought, the water table remained appreciably below normal, springs dried up and the need for checking deforestation abruptly brought out. The short rains began in December, 1934, and lasted only ten days and were far too brief for food crops, and unless further rains fall before the long rains the land will rapidly parch up again.

5. *General Remarks on Crop Production.*—Famine occurred in the Handeni District, and food shortages were reported from a few villages near Moshi and at Mbugwe in the Mbulu District. The people of Handeni are indolent and food shortages have been accentuated by their failure to plant cassava in the years of good rainfall. No food store is so sure or so lasting as that provided by such subterranean drought-resistant crops as cassava, edible canna and sweet potatoes. Strenuous efforts have been made to rectify the position.

6. Cotton is a crop which is essential to the rural economy of a great part of the Tanga Province : to Handeni and most of the Pares especially. In 1933 the rainfall was such a complete failure that many of the plantings of cotton and grain crops did not even germinate. Despite this there was a good reaction to the effort to revive the production of economic annual crops, but again failure of the rains during the optimum planting period, and abnormal late rains which fell when the cotton was flowering, had serious adverse effect on the final results. A desire on the part of the native population to achieve a higher standard of living, can be seen on every hand, e.g. it was decided to leave out of next year's cotton campaign one area in the Pares which has suffered severely over the past two seasons, and this immediately led to vociferous complaints from the natives concerned; in other areas we have had natives walking many miles to beg for cotton seed, and generally speaking the desire for help and advice is often evinced in an embarrassing degree and in striking contrast to four years ago. The fertile yet previously undeveloped Luengera Valley received attention for the first time; this valley has great possibilities for cotton and rice production. Such development will not interfere with sisal interests for comparatively little of the indigenous population is utilized as labour on sisal estates, also the production of one acre of cotton requires less than three weeks work giving a return up to Shs. 50/-; the food requirements of a native household is mainly the concern of the womenfolk, and amounts to from four to six weeks work. Thus the greater part of the year is available for other work with sisal, etc. The individual who can meet all his obligations in less than one month's labour must be counted a lucky man ; but even then with some people this small effort needs inducement.

7. The production of the principal export crops of the Northern and Tanga provinces, sisal and coffee, has been fairly well maintained. The decrease in the exports of sisal is due to the early drought and later to the fact that production in the Tanga Province was curtailed in the wettest months owing to difficulties in drying; export was also somewhat held up at the period of lowest prices. Production in the Northern Province was practically doubled.

8. The Kilimanjaro coffee crop was especially good; that of Arusha and Usa was much below the previous year owing to the drought; the coffee of the Oldonyo Sambu, Rasha Rasha, Oldeani and Babati areas also suffered somewhat severely. Many coffee estates which have followed the advice given to adopt more rational and prudent systems of cultivation and pruning have got over the biennial bearing habit with a variation in cropping from year to year of over seventy per cent., and are now producing crops with seasonal variations of less than twenty per cent. Yet notwithstanding this, and mainly owing to the heavy financial commitments incurred during the years of high prices, it must be realized that the position of our non-native coffee planters has improved but little. New plantings by non-native coffee growers are restricted whereas native planting, especially on Kilimanjaro and the Western Usambaras, has proceeded apace.

9. A reconnaissance was made by Colonel Homer, R.E., of an irrigation project for the Ruvu Valley in the Pare District; investigations of soil and water are still proceeding. The development under irrigation of the arid Arusha Chini area of the Moshi District has now got beyond the experimental stage, and the company concerned hopes to bring 25,000 acres under crop; mainly sugarcane and cotton. It is possible that a sugar factory will begin to operate in July, 1935, for the production of refined sugar; at present unrefined sugar is produced. Cotton has done extraordinarily well and yields of practically one bale of lint per acre have been obtained over large acreages. At Mbugwe in the Mbulu District appreciable non-native effort is contemplated, and clearing for a large cotton acreage in 1935 has already begun.

10. Development of the extensive alienated areas in the Eastern Usambaras remains at a standstill. *Criollo* cocoa is suitable to small parts of this area and offers what is one of the most profitable crops to-day; quinine appears to be another.

11. Many planters in the Northern Province have turned to maize as a cash crop, average yields of up to twenty bags per acre were obtained in 1934 and considerable clearing and opening up of new lands is taking place in the Moshi District. As will be seen later, this development is due to individual planters realizing that a sound effort is being made to organize the marketing of their produce.

12. The position of the farmers on the northern slopes of Mount Meru has become very serious due to the heavy drought of the past two years, and in order to assist them Government made a free issue of improved seed wheat.

13. *Soil Erosion.*—It can be said that no subject has received such wide and consistent attention by the department during the past five years as soil erosion, and somewhat satisfactory progress has been made especially with native agriculture. It is more difficult to achieve innovations with long established food crops than it is with such economic crops as coffee which have not been cultivated long enough to be trammeled by tradition or tribal customs; hence preliminary anti-erosion measures were mainly confined to the coffee crop, especially as such pests as thrips, and diseases as Hemileia and so-called "over-bearing" and "die-back" can often be directly attributed to the loss of the fertile top-soil. Following the demonstrations and propaganda of the years 1930-31 the native authorities of the Usambaras and Kilimanjaro enacted simple rules giving the agricultural officer full control of all new plantings of coffee, so that unsatisfactory planting sites are avoided and satisfactory anti-erosion measures are adopted. Similar rules have been enacted in the current year by the native authorities of Arusha and Mbulu.

14. The enforcement of these rules is undertaken by the agricultural staff, and while, as will be seen from the figures given below, the rules have resulted in drastic restriction of planting, with the explanation given to the individuals concerned and the demonstrations and propaganda consistently followed, the decisions of the agricultural officers and their native staff have been generally accepted without demur. The action taken on Kilimanjaro alone under the above rules for the current year is as follows:—

Number of applications	4,692
Approval to plant	2,670
Sites disapproved	2,022
Plots uprooted	1,550
Plots terraced	1,291
Plots contour trenched	225

15. The abandonment of clean weeding of coffee estates during the months of rainfall as advised by the department has proved a very effective anti-erosion measure.

16. Approximately two thousand food crop plots were contour trenched and/or hedged on Kilimanjaro. Large scale demonstrations of such anti-erosion measures were also held in the Pares and the Usambaras. As a result extensive areas of the former district are now well protected. Over twenty acres of the Lushoto Prison Farm have been terraced and excellent yields of potatoes and maize have been obtained.

17. A scheme for communal anti-erosion and reafforestation measures is under consideration for the Kilimanjaro area; if successful it will be applied in other districts.

18. During the year a further extremely important step in the anti-erosion campaign was taken on Kilimanjaro by the enactment of native authority rules to prohibit the cultivation of river and steep valley sides. The rules as they stand are not entirely satisfactory, but they have enabled something to be done to prevent the river valleys from being rapidly denuded as has occurred.

19. Again the application of these rules is undertaken by the agricultural staff, and in some instances, especially where the chiefs have little or no interest in the agriculture of their area, the "police" work necessary has reacted unfavourably on our proper advisory duties.

20. The subject to soil erosion is closely connected with that of water supplies. During the past year certain springs and rivers have completely dried up; this is more due to the deforestation which has occurred rather than to the poor rainfall of the past two years. In this connection Dr. Teale, Director of the Geological Survey Department, and Mr. Gillman, Chief Engineer of the Tanganyika Railways, carried out an investigation of the water supplies of the Northern Province. There is no doubt that irrigation has been grossly overdone in the past, and has caused the loss of the top-soil from a great deal of valuable land. It can be said that with the exception of the western area of Kilimanjaro of low rainfall, while a *skilful* and moderate application of irrigation water may increase crop production *in no way can it be regarded as essential.*

21. In the Annual Report for 1931 reference was made to the report of the Committee on Soil Erosion in Ceylon, wherein it was recommended that after the effect of educative methods has been seen the subject should be reviewed on the understanding that if conditions are still unsatisfactory compulsion by means of legislation should be considered. As will be seen above, compulsory measures have been adopted in this territory by the native authorities. The ready acceptance of our proposals by the chiefs and their people has been surprising yet only one section of the agricultural population is affected by the measures and, with the exception of the Usambaras where excellent progress with terracing has been made by all, it must be admitted that progress with the non-native section elsewhere has been disappointing.

22. Demonstration peasant holdings are being developed at Moshi and Lushoto to demonstrate the development of animal husbandry by the growing of fodder crops for stall feeding, the use of crop residues as fodder and the proper making and application of farmyard manure; also of crop rotation and the intensive cultivation of such permanent crops as coffee and fruit trees.

23. Before closing the subject of soil erosion, it is desired to place on record the excellent and arduous work carried out by Mr. A. Taylor, Agricultural

Assistant, with anti-erosion measures and the demarcation of riverside boundaries under the native authority rules. Also most of the native chiefs of the eastern part of Kilimanjaro, especially Marangu, and of Uru and Mbokom have given valuable assistance; but in other parts of Kilimanjaro where the chiefs have little or no interest in the agriculture of their lands or the future of their people, but little progress can be reported. Without exception every society of the Kilimanjaro Native Co-operative Union has given valuable assistance both by propaganda and in the field as in every other branch of our work. The chiefs of the Pares and the Western Usambaras have also keenly assisted. The influence of the chiefs for good or evil cannot be over estimated.

24. *Marketing.*—The year must be looked upon as one of eventful importance with regard to organized marketing. Planters have also shown a keen desire to get together to form territorial crop associations to support the formation of co-operative marketing bodies and to work harmoniously and whole heartedly with each other, with other associations and with Government for the common good. Both the maize and coffee planters have resolved that in placing their industries on as sound an economic basis as is possible locally there shall be no differentiation of race, nationality or creed within the different main associations or proposed societies.

25. *Maize Marketing.*—Over 90 per cent. of the non-native maize growers of all races in the Northern Province have organized a maize growers' association, and have unanimously agreed to form a co-operative society for the disposal of their produce. The ultimate object is to affiliate with the Kenya Farmers' Association and to work in close co-operation with the Kilimanjaro Native Co-operative Union, Ltd., which body, as will be seen below, has extended its marketing activities to maize and other crops as well as the primary product coffee. A constitution, as required by the Co-operative Societies Ordinance, is being drafted by the committee of the maize growers' association, and it is hoped that the society will soon be in active operation.

26. In September the committee of the maize association met the managing director of the Kenya Farmers' Association together with the Director of Agriculture and other representatives of Government. The desirability of inter-territorial co-operation for the marketing of maize was stressed, and pending the proposed organization of the Tanganyika Maize Growers' Co-operative Society the Kenya Farmers' Association generously offered services to enable the Tanganyika maize producer to export and market his crop. As a result over 15,000 bags of maize, mainly grown by Europeans, were exported at prices which could not possibly have been obtained otherwise. Such inter-territorial co-operation in maize marketing is intended not only to benefit the grower himself but also the consumer, and it is hoped that arrangements will be made to enable the important sisal industry to benefit by an assured all-the-year-round supply of good quality maize.

27. *Coffee Marketing.*—Coffee planters generally throughout East Africa have been mystified by the fact that while the commodity price of raw coffee has fallen considerably of late years the price paid by the consumer has remained practically steady. At the request of the Coffee Board Mr. E. Harrison, Director of Agriculture, visited Nairobi early in the year and consulted the Kenya Coffee Board. Planters generally were gratified to learn that the Coffee Board of Kenya was investigating coffee marketing, and the Kenya Board offered to place at the disposal of the planters of this territory information regarding this and other matters entirely without charge or

obligation. Later a combined delegation from the Coffee Advisory Board and the Convention of Associations attended a joint meeting at Nairobi with representatives of the coffee industry in Kenya, Uganda and Tanganyika, when it was agreed that the ultimate aim was a union of marketing organizations which it was hoped would be developed in each territory, and that there should be no distinction whatsoever between European-grown and native-grown coffee. It was also stressed at the conference which followed the meeting that the active co-operation of all trade interests should be secured, as success in co-operative effort could not be achieved if one particular section was eliminated. Later the chairman and secretary of the Coffee Board of Kenya, by invitation of the Tanganyika Board, addressed a representative meeting of the coffee planters of the Northern and Tanga provinces when the Kenya scheme was explained and discussed.

28. Planters are in general agreement that London is the best market for high grade coffee, but they feel that the lower grades should be bulked for sale elsewhere.

29. Except in the early part of the year when there was a good demand for coffee the market has been disappointing, and prices have been adversely affected by political developments in Europe which have caused currency difficulties and restrictive enactments. The average London price for coffee from the Northern Province is about £55 per ton—the highest known price is £98 for a parcel from Kilimanjaro. Arusha coffee turned out exceptionally light owing to the drought, and prices suffered in consequence.

30. The Kilimanjaro Native Co-operative Union, Ltd., exists mainly for the bulk disposal of the native-grown coffee crop in the Moshi District. This Union, within the short period of three years of its existence, has achieved great success. During the year the affiliated societies were increased from 16 to 27, and the total membership has risen from 12,577 to 18,554. Coincident with this, the structure and organization of the Union has also been extended. Twenty of the primary societies have built their own head-quarters consisting of offices, shops and storage accommodation for crops and spraying and bagging materials. Coffee is still the main crop of which 1,250 tons of the current season's crop has been marketed. Other crops handled by the Union include 30 tons of wheat sent to the Kenya Wheat Pool where all but one and a quarter tons was graded No. 1 and received an advance of Shs. 18/- per bag. Seven tons of kidney beans were also sold at Shs. 8/- per bag, as well as 168 tons of maize, 90 tons of onions and 16 tons of garlic, while 18 tons of hides which had been shade dried at centres erected by the Union were sold at an average price of 83 cents per kilogram. Just under £50,000 was distributed to members during the year.

31. The Pare rice crop was increased to about 800 tons; the crop was declared a cash product for that area, and auction markets were held. The local traders of those parts combined to render the scheme a failure. Native authority rules are being considered to ensure the sale of paddy only, as the native method of husking rice depresses its market value. It is hoped to raise production to 1,500 tons, hence a sound marketing system must be established if the grower and the province are to benefit as they should from this effort. A part of the crop was purchased by a local miller.

32. The dairy farmers of Ngare-Nairobi and Arusha are forming a co-operative organization and a co-operative creamery is now being built. The butter now produced by several farmers is of excellent quality. The

tinned variety produced by one farmer in the Ngare-Nairobi area has maintained its quality and increased its popularity.

33. *Cotton Marketing.*—Cotton prices according to the legal territorial scale were paid in the Upare, Korogwe, Moshi and Mbulu districts. The crop was purchased by the ginners, and a small amount of native cotton grown at Mbulu was purchased by the Moshi ginner.

Boards.

34. *Sisal Tax Board.*—A board was constituted during the year to administer the funds obtained from the tax on sisal. The funds are designed to meet recurrent expenditure in connection with the Sisal Experimental Station, to contribute towards the cost of consumption research in Europe, and to cover the costs of administration of the Tanganyika Sisal Growers' Association. The first meeting, held at Tanga in August, dealt with the estimates for the Sisal Experimental Station for the years 1934 and 1935. Matters regarding the site, staffing and preliminary operations of the Sisal Experimental Station were also discussed.

35. *Coffee Advisory Board.*—Four meetings of the Coffee Advisory Board were held at Moshi during the year. Some of the subjects discussed were marketing and advertising, coffee tax, restriction of coffee planting, amendments to existing coffee legislation, coffee cleaning and curing works, and the Coffee Research Station and its board of governors, etc. Representatives of Kenya, Uganda and Tanganyika agreed that there should be combined action of the three territories as far as local conditions permitted, and to this end it was recommended that the territories concerned should organize coffee boards on lines similar to Kenya, after which it is proposed that a joint standing committee be formed to act as a liaison and to ensure unity of action when desirable throughout the three territories. This was confirmed by the Coffee Association. The first meeting, held at Tanga in August, dealt with the proper organization of all coffee planters throughout the territory in one association or union and for the reconstitution of the Tanganyika Coffee Board. The report is being printed for issue to all coffee planters for their consideration. It was also agreed that the London representative of the Kenya Board should represent the Tanganyika coffee planters on the coffee section of the British Empire Producers' Organization.

36. The Coffee Advisory Board has maintained close touch with the Kenya Board, and it is especially indebted to its chairman and members for their assistance and advice in several matters and for their invitation, extended to all coffee planters of Tanganyika, to attend the Coffee Conference and Planters' Days held in Nairobi in July.

Crops and Cultivation in Detail.

37. *Sisal.*—The following are the exports over the past four years:—

PROVINCE	1931 Tons	1932 Tons	1933 Tons	1934 Tons
Tanga	38,113	40,487	45,329	40,614
Northern	1,718	1,775	2,490	4,887
Totals ...	39,831	42,262	47,819	45,501

The value of the 1934 exports is approximately £535,000 as compared with £554,059 in 1933 and £496,000 in 1932. In addition 754 tons of binder twine were exported in 1934 valued at £18,458.

38. Serious drought effects in U.S.A. and their result on the wheat crop, and also political trouble in Europe, have had serious effect on the sisal market, while rope makers appear to have made increasing use of manila hemp presumably at the expense of sisal. The price of No. 1 grade sisal at the end of 1933 was £15 (it had risen to £18 10s. in September, 1933, from £14 at the beginning of that year), it fell to £13 15s. in August, and to £13 7s. 6d. in October. The difference of Shs. 10/- which exists between the first and second grades is no encouragement to better preparation or grading.

39. Although exports are some 2,000 tons less than last year's record figures, there is no doubt that but for the difficulty of drying the sisal during certain wet months, and to the fact that certain estates held up their sisal during the slump prices, higher figures would have been achieved. The effects of the previous year's drought also depressed yields. The rope factory erected near Tanga came into operation and accounted for a further 1,000 tons of sisal.

40. Development is now greater than for some years, and new plantings have been made not only in the coastal sisal belt but also in the more remote areas of Arusha. New machinery has been installed on several estates and new areas will soon be in production, especially in the Moshi and Arusha districts. Utilizing the advice and equipment of the Geological Department a score or so of estates have now put down bore-holes to obtain water for factory use.

41. A representative collection of exhibits, illustrative of the type of consumption research which is being carried out in Europe, was obtained through the good offices of Mr. F. A. Stockdale, Agricultural Adviser to the Secretary of State for the Colonies, and Major E. O. A. Newcombe, the Secretary of the British Empire Producers' Organization. These were exhibited at Tanga, Moshi and Dar es Salaam, and then loaned to the Kenya Department of Agriculture for display in that colony. The exhibits aroused great interest, showing as they did such diverse uses previously not guessed at by the planter. Amongst the exhibits were the following :—panels made of sisal waste and of tow and resin ; sisal twine, hat cloths, etc. softened and bleached with H.G. ionised oils, ribbonised sisal, webbing, pannels of sisal waste and cement ; specimens of resistent floor-coverings of ionised oil-treated waste and tow plus rubber latex ; a cotton-wool substitute ; panels of rozolite products, also of sisal belting and sisal reinforcement building-blocks, etc.

42. *Agave Amaniensis*.—The new species of the sisal family discovered two years or so ago at Amani has aroused interest. The tests and development of *A. Amaniensis* are being carried out by the East African Agricultural Research Station and the new Sisal Experimental Station will do much to accelerate progress.

43. *Sisal Experimental Station*.—After discussion by the Sisal Tax Board and examination of possible sites by a sub-committee of this board, a freehold site was selected at Mlingano, fourteen miles from Tanga near to Pongwe Station. Mr. G. W. Lock, District Agricultural Officer, was appointed as officer in charge of the station with Mr. Fowler as his agricultural assistant. Entry on to the land was made in November and clearing was begun.

44. Drought and vermin rendered useless most of the sisal observation plots laid down on private estates in the previous year. Sisal root systems were washed out. These showed that the bulk of the roots occur in the top twelve inches of soil with maximum penetration to eighteen inches ; thus, if

care is not taken, serious damage can easily be done to the roots by cultivation. At one estate, sisal deeply and continuously cultivated by mechanical means poled within two and a half to three years (no leaves were cut), whereas uncultivated sisal in a garden nearby did not pole until the sixth year.

45. With regard to cover crops the Sisal Experimental Officer reports as follows :—

"*Crotalaria Usaramoensis* did well on a poor sandy soil ; germinates easily and grows quickly providing a good cover of about two and a half feet high for five months. Its principal drawback is that it tends to run to seed easily, despite lopping back, but will regenerate itself during subsequent rainy periods ; it has rapid seed multiplication. Density of cover varies with the rainfall, but plants will persist during a dry season.

"*Canavalia Ensiformis* under favourable soil and rainfall conditions provides an excellent cover from 12-18 inches high, but under dry conditions and low soil fertility it is disappointing, and will not stand heavy lopping. It is more of a temporary cover, resowing being necessary after 12-18 months. Germinates and grows very quickly in rain. Large quantities of seed can be obtained if growth is good.

"*Calopogonium Mucunoides* soon provides an excellent mat of vegetation on soils in fairly good correct, and gives a perfect cover, resulting in a valuable mulch of dead leaves. Prefers a fair rainfall. Will regenerate itself. Unfortunately it is a climber, though not a vigorous one, and later will need to be pulled away from sisal plants. Unless the land is not fairly clean initially it will not overcome the stronger grasses.

"*Dolichos hosei.*—This plant can make a perfect low non-climbing cover but is difficult to establish in sisal and cannot compete with heavy initial weed growth. It does better under shade. Does not seed easily but may be propagated from cuttings. It is not likely to be successful in sisal but is worth a trial.

"*Bonavist beans* will produce a cover quickly though not of a permanent nature. Main fault is its climbing habit.

"*Crotalaria Striata.*—This tall plant will grow fairly easily on most soils and is permanent, but is objectionable because of the shade it provides.

"*Crotalaria Invantulensis* has not been a success in the Northern and Tanga provinces except on soils of volcanic origin.

"*Indigenous legumes.*—The ideal cover crop in sisal has not yet been determined, each one having a drawback of some nature. Of those listed above, all warrant a trial, and possibly the first three will prove most satisfactory. Climbing legumes are usually vigorous growers, but it should not be too expensive to keep the sisal plants clear periodically. *Crotalarias*, *Indigoferas* and *Tephrosias* are worthy of most attention, as a plant suited to local climatic and soil conditions is more likely to be found from these groups.

"Green manuring of sisal is not feasible due to surface root damage and expense."

46. *Sisal Weevil.*—The rainless weather conditions of 1933-1934 had the effect of weakening sisal, and fields presented favourable material for establishment of the sisal weevil, *Scyphophorus acupunctatus*, Gyl. The weevil incidence in the plantations increased, but such seasonal increases are phenomena recognized and accepted by the experienced and observant sisal planter. The incidence of the recent wave cannot by any means be compared with the condition existing in 1921, when the problem first came under the

attention of the Entomologist : up to 200 adult weevils could then be commonly recovered from a single decomposing sisal base. This department (in common with other departments of agriculture abroad interested in sisal) has continued to emphasize the prime importance of field sanitation to deprive insects of suitable breeding material, without which multiplication to excessive numbers is an impossibility. The distribution of the weevil in the Tanga Province (to which it is confined) continues to be the same, and no sound evidence has been forthcoming which will warrant a change of opinion on the economics of the pest as a factor in sisal production. Systematic plantation sanitation and a high standard of field management to maintain vigorous growth should suffice to hold the pest in check.

47. *Coffee.*—The following are the amounts of parchment coffee exported over the last four years, by districts :—

DISTRICT	1931 Tons	1932 Tons	1933 Tons	1934 Tons
Arusha (with Mbulu) ...	838	1,329	2,223	1,316
Moshi	1,636	2,539	2,386	2,891
Usambara	188	239	166	172
Totals ...	2,662	4,107	4,775	4,379

48. These amounts were shipped via Tanga or Kilindini as follows :—

PORT	1931 Tons	1932 Tons	1933 Tons	1934 Tons
Tanga	1,265	1,509	1,726	1,194
Kilindini	1,397	2,598	3,049	3,185
Totals ...	2,662	4,107	4,775	4,379

In 1930, 58 per cent. of the exports were railed via Tanga ; this fell to 47 per cent. in 1931 ; to 37 per cent. in 1932 ; to 36 per cent. in 1933 and to 27 per cent. for the year under review. This decrease in railings via Tanga is mainly due to the increasing patronage given to the Kilindini Curing Works and to a lesser degree to the fact that some planters dispose of their lower grades of coffee on the Nairobi market. It represents a serious loss in revenue to the Tanga railway ; the erection of a coffee curing works at Moshi should rectify the position.

49. The amounts of (A) estate and (B) native coffee produced for export over the past four years are as follows :—

DISTRICT	1931 Tons		1932 Tons		1933 Tons		1934 Tons	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
Arusha ...	805	35	1,285	44	2,123	100	1,271	45
Moshi ...	1,073	563	1,506	1,033	1,378	1,008	1,361	1,530
Usambara...	188	—	224	15	151	15	152	20
Totals ...	2,066	596	3,015	1,092	3,652	1,123	2,784	1,595
Grand Totals	2,662		4,107		4,775		4,379	

50. Following the advice given in Pamphlets Nos. 7, 8 and 9 (especially as regards cultivation, pruning and irrigation), the biennial bearing habit has been broken on many plantations. Previously, differences in yield from year

to year were often as high as 75 per cent., whereas on many estates bearing is now more consistent from year to year with annual *seasonal* variations of but from ten to twenty per cent. Furthermore, taking the two years 1930 and 1931 the average yield over a group of estates was 2·9 cwts. per acre. In 1932 and 1933, years of much poorer rainfall, the average yield over the same estates had risen to 3·98 cwts. per acre. Under the methods advocated by the department costs of production have also been greatly reduced. In 1930 it was said by one planter in praise of another's "high standard of coffee culture" that he "cultivated four times, pruned five and irrigated six times in the year"! This kind of praise is rarely if ever heard to-day.

51. As well as following a more reasonable programme of cultivation and pruning, the views of planters regarding irrigation have also largely changed. The District Agricultural Officer, Arusha, states that as far as his area is concerned they are now generally in favour of the pit method as recommended in Pamphlet No. 9, as it is regarded to be more economical of labour and water and is carried out without that damage to the soil and to the coffee trees which was seen with the formerly common saucer method. Where practised irrigation is now more commonly carried out earlier in the season with the idea of prolonging the growing period rather than to relieve drought conditions. There is evidence of the value of the above at Oldeani where water is by no means abundant. One cusec of water is considered to be sufficient for 500 acres with the pit system. Irrigation, skilfully practised, can also be used to bring blocks of coffee into flower and so into bearing in rotation; and this relieves labour and factory difficulties at harvest time.

52. The District Agricultural Officer, Arusha, also reports that: "Most planters very fully realize that we are not in a position to make definite statements on many aspects of coffee cultivation, and many are willing and anxious to debate controversial matters and to try out various theories. This willingness to help, and appreciation of our attempt to assist, very greatly smooths over the difficulties of an agricultural officer working largely in a non-native area." It was just that spirit that invited and encouraged the publication in pamphlet form of our opinions and observations on coffee culture, and it is gratifying to learn from many planters both near and far afield that they have benefited by the pamphlets.

53. The work and research of Mr. Nutman, Plant Physiologist, East African Agricultural Research Station, together with the experiences of various planters and further observations have shown that we have (happily) underestimated the power of the coffee tree to recover from adverse conditions, and more especially from damage to the root system. Nutman has shown that the growth of all vegetative parts, including the roots, depends on a sufficient supply of carbohydrates; this in its turn depends on ample leafage, which is again largely dependent on a fertile soil and a good root system. It appears that where coffee is carrying a good crop there is a heavy demand on the carbohydrate supply to develop and ripen up this crop; consequently there is but little if any carbohydrate to spare for the growth of shoots or roots. Thus if the roots are cut or damaged by deep cultivation there is little or no regeneration where there is the strain of cropping; where there is no such strain, where the soil is fertile and the root system is interfered with as little as possible, then regeneration of the roots takes place. There are now many examples of plantations of coffee which four years ago were very poor and almost derelict, and which, following more reasonable management, have recovered and are now in good condition.

54. In fact it has been seen that no matter how old the tree may be, if it is stumped back and the roots pruned to within a few inches of the main tap root the stump may be transplanted and will grow well provided it was not suffering from over-bearing and die-back prior to transplanting. Thus it is possible that where it is difficult to make refills in mature coffee or where young plants suffer unduly from eelworm attack, or the rainfall conditions are adverse to planting out young seedlings, then success may be attained by the planting of well-grown two-year-old stumps. This method is actually followed with tea in parts of India, nurseries being situated at the lower altitude where growth is fast, and stumps are transported long distances for planting in tea fields at the higher altitude.

55. *Native coffee.*—The production of native-grown coffee on Kilimanjaro reached the record output of 1,530 tons. The position of this industry must be regarded as good when compared to the unsatisfactory state of affairs of three to four years ago. In the Annual Report for 1931 it was stated that "the Kilimanjaro Native Planters Association has been of little or no use to the department in the work of cultural improvement, neither have they been satisfactorily equipped with spray pumps and chemicals to deal with coffee pests and diseases." Again in regard to the marketing of the native-grown coffee crop it was noted that "departmentally we have been completely impotent to effect an improvement in this matter, which has greatly handicapped our work to effect improvements in both the culture and preparation of native coffee." All this has been changed, and the credit for the more satisfactory state of affairs is mainly due to Mr. A. L. B. Bennett, the manager of the Kilimanjaro Native Co-operative Union, and to Mr. C. Harvey, District Agricultural Officer, and his assistants, who in their work of the past four years have contributed largerly to that close co-operation now existing between the society and the department, and which is so essential to our work and the aims and success of the society.

56. In addition to marketing the society has undertaken to carry out with our advice the organization of anti-pest and disease control measures. The keenest interest is taken by all the native officials of the society in the regulations affecting coffee, and in all agricultural matters generally. They are invaluable and active in their assistance to the agricultural staff in the field, and form one of the best media for getting the peasant coffee grower to react favourably to our advice. The force of public opinion alone is now sufficient in many areas to cause the eradication of derelict and pest-ridden coffee. In many areas there is similar close co-operation with the native chiefs. Where the native chiefs are not interested one may find the greatest obstacles to improvement, and there conditions are most backward.

57. The two agricultural assistants concerned with native coffee have with their native staffs made 20,467 inspections of bearing coffee, in addition to 6,242 inspections of newly-planted coffee.

58. The native-grown coffee on Mount Meru is not in a satisfactory position; this is largely due to the fact that the native coffee growers have not been formed into a co-operative society. Advance has, however, been made with many individual growers. In the Usambaras, where the native chiefs and the natives themselves are very keen, increase in plantings have been made, but owing to lack of staff it has not been possible for a European officer to supervise these as frequently as is desirable.

59. *Coffee Pests and Diseases.*—Bordeaux spraying is becoming more generally adopted; its great value being the maintenance of leafage. Leaf-

miner has become a serious pest of late years, and there are indications that a combined bordeaux and nicotine spray will control this. Thrips proved a serious pest in the drought affected Arusha areas. Green scale was also a serious pest in Arusha. Owing to locusts and shortage of staff it was not possible to organize "block-spraying" for Antestia as heretofore. White borer (*Anthores leuconatus*) is still one of the major pests of coffee, although there can be no excuse for any serious infestation where normal routine measures are carried out. Intensive campaigns are organized each year with native coffee, and the number of trees which it was found necessary to uproot because of this pest show an appreciable decrease on previous years as also in the number of borer grubs extracted. Several orders were served on non-natives for failure to deal with this pest and one prosecution was necessary. Additions have been made to the schedule of wild hosts of borer, and since the campaign began for their eradication over 2,000,000 trees have been uprooted in the Moshi District and some 250,000 in the Arusha District. The position remains unsatisfactory in a few areas where the native authorities are apathetic. Further information on pests will be found in the report of the Entomologist. The Mycologist deals with the diseases of coffee in his report.

60. *Experimental.*—The administration, progress and work of the Coffee Research Station is dealt with by the Chief Scientific Officer. Observations on the Selian Estate plots were continued by Mr. Sturdy, District Agricultural Officer, Arusha. These will be taken over in 1935 by the Chief Scientific Officer, who has expressed his appreciation of the observations carried out by Mr. Sturdy. It is desired to record appreciation of Mr. G. Bloom for his co-operation in placing this area of his estate at our disposal for experimental use.

61. Early in the year Messrs. Sturdy, Harvey and Sanders carried out block excavations of coffee root systems, using the method described by Rogers and Vyvyan of East Malling, which deals with and accounts for the whole of the root system, and eliminates the error which occurs when the trench system is used. The results are too long to give in detail, but it was found that the majority of the roots of the coffee tree, as actually weighed, existed in the top 25cm. of soil. In one instance, typical of the excavations, the total weight of roots in the top 25cm. of soil amounted to 52 per cent. of the whole root system, whereas trench sections taken at different parts gave results of 48, 41, 38 and 33·5 per cent. Thus it will be seen that the trench method of root investigation may give a thirty per cent. error.

62. Samples of parchment coffee from various estates were obtained for the Geneticist, East African Agricultural Research Station, at his request.

63. *Coffee Curing Works.*—A licence was granted to a local firm to erect a coffee cleaning and curing works at Moshi, but this was surrendered. Two more applications are now under consideration.

64. *Tea.*—26,354 pounds of made leaf were produced during the year by two estates in the Usambaras. The plucked leaf is transported to the factory of the larger estate from the other. Advice given on the methods of plucking and pruning by Mr. F. W. Thomas, District Agricultural Officer, resulted in an increase in yield of leaf of 100 per cent. without loss of quality. On one plantation Armillaria continues to cause severe losses, and shows the necessity when clearing land in the Usambaras for stumping and digging out the roots of the forest trees and the essential need for anti-erosion measures to be laid out before planting. Clean weeding as previously practised has been dropped with good results to the health and vigour of the tea bushes.

65. *Cocoa.*—Only two and a half tons of cocoa were exported during the year as compared with nine tons in the previous year. The quality of this Criollo cocoa is very highly regarded by chocolate manufacturers at home, who have expressed their disappointment that the crop has not been more widely developed in Tanganyika Territory. The amount of real high class cocoa (as that of Sigi Segoma Estate) produced in the world is an extremely small proportion of the total production. Also there is a tendency for supplies of Criollo cocoa to diminish due to hybridization with other poor types, while the public demand for high class chocolate is increasing. Thus it is more than possible that the price of Criollo cocoa will show a large advance in the next five years or so.

66. *Kapok.*—The production of kapok was less than half the record output of 1933: 64 tons to the value of £4,744 were exported. The fall is mainly due to the drought effects of 1933 rather than to the lower price obtained.

67. *Cinchona.*—Just over tree tons of quinine bark were exported during the year. The exceptionally high prices obtained for this product from the Eastern Usambaras, and especially that prepared by the East African Agricultural Research Station has excited interest in this crop and there is now a demand for seed.

68. *Copra.*—The exports of copra from the Tanga Province, mainly to Zanzibar, was 1,510 tons valued at £9,868. 214 tons of copra were used by local soap makers. In 1930 the production of copra amounted to 5,580 tons. The serious decline in exports is due to the neglect of plantation care and upkeep which has followed the drop in price; also many owners do not even bother to pick the nuts.

69. A processing tax amounting to £22 4s. per ton has been imposed in the United States on all foreign coconut oil, but the drop in price of oil products is mainly due to the scientific process of hydrogenation of oils which enables almost any class of animal or vegetable oil to be turned into any other type of oil. Thus the cheapest form of oil (which to-day is whale-oil) is employed by manufacturers. It can then be seen that with a depressed and falling market only the best qualities of any product are in demand, and unless the copra producers of this territory improve their methods of preparation the industry will become defunct.

70. *Cotton.*—The sales of seed-cotton by natives amounted to 245 tons, vlaued at £2,300. Non-natives produced approximately 355 tons of seed-cotton in the Moshi District in 1934, 45 tons in the Arusha District and 15 tons in the Mbulu District. The total production in 1933 was 98 tons. Thus the total production of cotton in these provinces in 1934 was approximately 650 tons. The export of lint from the Tanga and Northern provinces for 1934 was 1,447 bales of 400lb.

71. Seventy-seven tons of cotton seed were issued to natives for the 1934 season, 130 tons will be issued for the 1935 season, and an increase in non-native cotton will be made in 1935, especially in the Mbugwe area where it is expected that some 3,000 acres will be planted.

72. *Maize.*—As stated above much has been done by the maize planters towards placing this young maize industry on a sound economic basis, and this has resulted in large new clearings and development of the lower slopes of Kilimanjaro: in addition to existing maize lands 4,000 acres of virgin bush have already been cleared for maize for 1935. During the year 1,645 tons of maize and maize flour were railed from Moshi and 507 tons from Arusha

down the Tanga line while 1,520 tons were exported over the Kenya-Uganda Railway representing a local production of over 40,000 bags.

73. *Citrus.*—Several hundred tons of citrus fruits were railed from Muhesa, Tanga Province, to markets on the Tanga line and to Nairobi and Mombasa. Trial shipment of oranges to the home market and to Bombay were made as in past years with encouraging results. Muhesa is able to produce oranges practically throughout the year; its main crop coming on in July and August. Shipments can thus be made to England when the market is not overburdened with fruit from elsewhere. There is no doubt that a flourishing industry could be built up with oranges and grapefruit of excellent quality.

74. *Other Products.*—(i) Planters have shown increasing interest in tobacco and several are now growing this crop in the Moshi, Korogwe and Handeni districts. One planter manufactures shag and cheroots for the local market, and a ton and a third of manufactured tobacco were exported from Tanga.

Those who tried Madagascar butter beans in 1933 were disappointed in that the London market would not take their beans because of a faint black mark on the seed coat (it is understood that this is due to too much sun at and prior to harvest); it is not regarded as a blemish by the Canadian market, and it is intended that the Maize Growers Association's proposals will aid growers of both butter and kidney beans to dispose of their produce to better advantage.

(ii) Thirty tons of wheat grown on Kilimanjaro by natives were exported, and an effort is being made to build up a native wheat-growing industry in Mbulu, 100 bags being produced by them during the year.

(iii) Over 300 tons of onions were exported mainly from Moshi, to a value of approximately £3,000. Four years ago onions were all imported, it being held that the Indian and Egyptian product was superior. This was proved a fallacy and a valuable side line has been given the native by the propaganda and work of this department.

(iv) The price of chillies has fallen considerably, and hence this crop, which is troublesome to harvest, has fallen out of favour: only eight tons were exported.

(v) There have been extensive plantings of cassava, in pursuance of the anti-famine policy. Several hundreds of tons of dried cassava were railed during the year, and export of this product has been made for the first time to Mombasa (previous to the year 1932 railings amounted to some 60 to 70 tons only).

Edible canna has been made more widely known and increased plantings have been made.

(vi) Ramie. Negotiations regarding this crop have been made with a London firm who have achieved considerable progress in the factory treatment of the fibre, which allows them to take bark strips or ribbons whereas previously only the expensive retted china-grass could be utilized. Trial consignments have been provided, and if results turn out satisfactorily there is every possibility of developing a new industry. At present it appears that the crop can best be grown by natives as a yard crop in areas of high rainfall.

(vii) Papaine. One planter in the Arusha District produced 600lb. of crude papaine which realized £210. The price has increased from Shs. 3/9 to 7/3 per lb. in 1933 to Shs. 7/3 to 11/6 in 1934 and it is stated that consumption is increasing; on the other hand some firms consider that appreciable increase in production will result in a glut on the market and fall in price.

75. The citrus demonstration plot at Muhesa has been extended, and is now completely terraced for planting up with Marsh's Seedless Grapefruit as it is considered that this will be a profitable crop, and it is desired to arouse further interest in it not only locally but also abroad by larger trial shipments. The Native Authority Farm at Lushoto has continued its good work: well over a hundred tons of Potchefstroom Pearl maize have been issued to natives over the past four years, as well as many tons of Great Scott and Kerr's Pink potatoes. It is desired to develop this farm as a mixed holding of coffee, fruit, grain and root crops, with stall-fed dairy cattle. The Handeni Native Authority plot has been of value in its production of planting material and foodstuff of cassava.

76. *Locusts.*—An invasion of red locusts (*Nomadacris septemfasciata*) occurred over most of the Tanga and the Northern provinces, being more serious in the former area. In Handeni famine rendered the campaign more difficult. Extensive anti-locust measures were carried out in the Taveta-Maktau area of Kenya, as in every year since 1930. Planters expressed their appreciation of the work done by the agricultural assistant who was posted to that area. It reflects great credit on all those officers of the Administrative, Agricultural, Educational, Forestry and Veterinary departments and the King's African Rifles, as well as the native authorities concerned, that contrary to mischievous and ill-founded rumours practically all accessible hopper bands were destroyed, and extremely little crop damage occurred except in the Handeni District where cotton suffered. In the Arusha District, however, the natives and their chiefs were apathetic. Towards the end of the year, while the Northern province is free of all but a few sparse swarms, the outlook for 1935 in Handeni and Korogwe is more serious.

77. *Agricultural Show.*—A show was held at Sanya, and following its success planters are anxious to organize a provincial agricultural show in 1935.

78. *General.*—The Director of Agriculture (Mr. E. Harrison) visited the Tanga Province on three occasions and the Northern Province five times during the year. Messrs. C. Harvey, Acting Senior Agricultural Officer, and F. R. Sanders, District Agricultural Officer, attended the conference held at the East African Agricultural Research Station, Amani, in February. Mr. A. J. Wakefield, Senior Agricultural Officer, together with Messrs. Gilbert, Chief Scientific Officer, and F. R. Sanders, Coffee Experimental Officer, and Mr. A. H. Ritchie, Entomologist, visited Nairobi in July to attend the coffee conference. The usual close contact has been maintained with the officers of the East African Agricultural Research Station and the Kenya Department of Agriculture, and acknowledgment is made of the ready assistance and advice which is always accorded to us by these officers.

79. Many desirable activities of the department have had to be abandoned simply because there has not been time to see to them; increased production, anti-locust measures, anti-famine measures and countless calls for assistance and advice by European planters all must receive prior attention. Yet it is pleasant to look back on the year's work of the agricultural officers in the field and to know that without exception all have done far more than might be expected of them. Also district officers have taken a practical and active interest in the development of their areas; it cannot be denied that unless there is the closest co-operation between agricultural and administrative officers and also with the native chiefs, development is severely handicapped. European enterprise has been more active and has proved itself to be less discouraged by temporary adverse conditions than is the case with the native,

and it is considered if the efforts made over the past three years to increase native production are continued, then, with the results already achieved with annual crops by the non-native producer the Tanga and the Northern provinces will quickly reach that state of comparative prosperity desired by all.

A. J. Wakefield,
Senior Agricultural Officer,
i/c North-Eastern Circle.

Annexure II.

ANNUAL REVIEW OF THE NORTH-WESTERN CIRCLE.

Lake and Western Provinces.

1. In spite of the fact that district agricultural officers have been posted to the Kigoma and Biharamulo districts and an agricultural assistant and district foreman to the Shinyanga and Tabora districts, the circle is still understaffed. Agricultural officers are required for the rapidly developing and increasingly productive districts of Musoma, Bukwimba, Nzega and Kahama; and an additional officer is required for the lake shore and islands.

2. The departmental native staff was entirely inadequate, and to overcome the difficulty it was combined with that of the native authorities of the Mwanza, Bukwimba, Maswa and Shinyanga districts to form the "Lake Province Production and Marketing Corps" under a European supervisor. At the close of the marketing season the services of the supervisor were dispensed with, and for the sake of economy the staff was disbanded and reorganized on a district instead of a provincial basis. In the Western Province it has been necessary to augment the permanent native staff by the recruitment of a large temporary staff.

General.

3. Throughout the circle the early rains were favourable and a considerable increase in the area under cultivation was recorded. An exceptionally severe drought followed which caused the complete failure in many areas of the groundnut and rice crops and considerably reduced the yields of all staple food crops. The main rains were short and light, but their distribution was favourable and the late planted food and cash crops benefited, particularly cotton; under such conditions it is not surprising that in many areas food shortages and even famine conditions prevailed.

4. Crop failures, food shortages and famine are usually attributed to unfavourable weather conditions and, although in a general sense this is true, it is equally true that the failure of the cultivators to take full advantage of the rains and their pathetic ignorance of modern agriculture are in a large measure responsible.

5. In a previous annual report the risks of farming under semi-arid conditions were referred to, and it was pointed out that they could be minimized by the selection of varieties to suit the conditions, the rotation of crops and the judicious use of manures. The development along these lines has been such that, apart from the normal food and cash crops, we have now a range of what one can term insurance crops which have been proved suitable to local conditions. These are either semi-permanent like cassava and pigeon peas or quick maturing like feterita sorghum, awned bulrush millet, tepary beans and virginia bunch groundnuts. These crops mature in about ninety days and, planted either before or after the normal crops, give a fair yield. They are not intended to oust the normal crops but are an insurance against their failure and if the native can be educated to their use then food shortages and famine should be rare.

6. The cotton and coffee crops were approximately 26,000 bales and 10,000 tons, beating their previous records by over 10,000 bales and 2,000 tons respectively, so that money was plentiful and large quantities of food and cattle were purchased to augment local supplies.

7. The Western Province has to be congratulated on the enthusiasm displayed by all officers in the agricultural development of their districts. The Provincial Commissioner is determined to place his province on the economic map of the Territory, and cotton has now been added to its list of cash crops. An energetic campaign has resulted in the distribution of over four hundred tons of cotton seed. The area under rice in Kigoma was the largest on record.

8. The cultivation of coffee in Bugufi is now established and this new industry promises well, and the production of heavy western tobacco in Biharamulo reached twenty tons as compared with a production of two tons last year.

9. The cotton crop in the Bukwimba District was phenomenal and reached 5,500 bales as compared to 600 the previous season. Maswa maintained its previous high level with a crop of nearly 6,000; and Mwanza District, including the islands, created a new record with 12,000. The production in Musoma fell from 1,000 to 500 bales, but Shinyanga reached the 2,000-bales mark. In spite of adverse conditions Tabora, Nzega and Kahama managed to export considerable quantities of foodstuffs and a 5,000-ton groundnut crop.

Experiment Stations.

10. The work at the experiment stations is becoming more and more defined and of increasing importance. The development in the field is only an extension of what has been proved by experiment to be sound, so therefore this work is the mainspring of all agricultural progress and education. Changes due to transfers and leave are inevitable but the continuity of the work has, as far as possible, been maintained.

11. Cotton is the premier cash crop of Sukumaland. Two types are grown; an early maturing U/4 type which was introduced from Barberton in 1929-30 and an Upland type the seed of which came from Uganda many years ago. This Uganda Upland cotton is grown throughout the cotton-growing areas in the circle with the exception of the drier areas of Shinyanga, Kahama and Nzega, where the U/4 types are grown. The lack of staff, funds and equipment curtailed considerably the necessary and important work of selection and improvement but this has been remedied by a generous grant-in-aid from the Empire Cotton Growing Corporation.

12. This grant has enabled a start to be made in the programmes submitted for the development of the industry. This includes, amongst other things, the erection of a house at Ukiriguru and the transfer of the district agricultural office from Mwanza to the experiment station; the opening up of a cotton seed multiplication farm in Uzinza and the erection of a house and the posting of an agricultural assistant to this fertile and promising area; the extension and improvement of the U/4 multiplication farm at Lubaga, the repair of the existing house and the posting of an agricultural assistant there.

13. At Lubaga the extension area is adjacent to the experiment station and native authority farm; but as Ukiriguru is situated in a densely populated agricultural area the acquisition of more land was out of the question and we had to look further afield for an extension area.

14. There are large tracts of naturally fertile soil in the sparsely populated area of Uzinza, to the west of Smith's Sound, and a block of 14 square miles has been acquired by the Department. A site was selected in June and an agricultural assistant was posted there in July. A temporary *banda* and labour lines were erected and the land is rapidly being reclaimed. Six thirty-acre blocks have been cleared and four of them will come under cultivation this season. The property is approximately seventeen miles from Mwanza and is reached by motor boat in one and a half hours. An alternative is to cross by motor boat or canoe from Mwanza to Karumo and then by the main Karumo-Buchosa road which runs through the farm.

15. The area consists of a cotton seed multiplication farm divided into thirty-acre blocks. Each block is separated by a protective belt of timber fifty yards broad, and the whole is surrounded by a reservation half a mile deep. A small frontage has been reserved on the lake shore for a pier and a large swamp for the cultivation and propagation of rice. The remainder of the area has been reserved for peasant holdings, thirty-two of which have already been taken up.

Native Authority Farms.

16. These farms are a necessary adjunct to an experiment station. Their prime object is to propagate, by up-to-date methods, improved varieties of seed for distribution to native cultivators. They are the recognized seed merchants of the district, purity and quality being guaranteed, and are also the centres of instruction and demonstration.

17. The best method of illustrating better farming methods to illiterate natives is by ocular demonstrations. It is important therefore that these farms should be models and that the agriculture practised and crops grown should be superior to anything in the vicinity: otherwise they fail in their objective. Furthermore, from the economic point of view, where the object is the production of good quality seed it is necessary that particular attention be paid to cultural methods and soil fertility in order to obtain the highest yield per acre at a minimum cost. Desirable, therefore, as these farms are, they must of necessity be confined to districts where there is a resident agricultural officer to undertake the work.

18. Mwanza District: Ukiriguru is the largest educational centre in the circle. It is the training ground for native instructors and the "Lake Province Marketing and Production Corps" attended a school which dealt with such subjects as the weighing and grading of produce and the rapid use of ready reckoners.

19. On a 200-acre block of land is demonstrated in a practical manner the objectives of the department and the improvements which have been made in local agriculture, from the experiment station to the seed and demonstration farm, to the demonstration plot, to the ideal native holdings. Here one can see the peasants contentedly using the simple home-made wooden plough while a little further on the most modern ploughs, ridgers, harrows and inter-row cultivators are at work; ox-drawn carts carting litter and fodder to the covered cattle sheds and the peasant holders doing likewise on a smaller scale; well made farmyard manure being carted and spread on the fields and hand-reared calves greedily drinking milk from buckets while work oxen return to the covered pens having drunk their fill at the dam, and a continual stream of natives passing to and from the seed stores exchanging and receiving issues of improved seed.

20. The District Agricultural Officer reports: "The value of the farm as an educational centre is increasing. Chiefs from other places and interested parties have been conducted round the farm, also local natives are now showing a definite interest and frequently visit the farm for advice and help, or simply stroll around to see what is being done."

21. At Lubaga the main object of the farm was to raise U/4/4/2 cotton seed, but it is now being organized on the lines of Ukiriguru and two ideal holdings were established before the close of the year. Particular attention has also been given to the demonstration of anti-erosion measures following on the lines of the Mwasita and Shanwa farms. An experiment to demonstrate the advantages of rotational grazing has also been started.

22. The foregoing describes farms which are adjacent to experiment stations, but similar farms laid out on a smaller scale and with the same objects in view are maintained in the Maswa, Biharamulo, Tabora, Kwimba, Nzega and Kahama districts. The three latter farms are run by the district officers in connection with the native authority schools.

23. At Ngudu (Bukwimba) and Shanwa (Maswa) dairy herds are maintained, and at the latter place considerable attention has been paid to anti-erosion measures and crop rotations.

24. The value of these farms to the districts is best described in the following extracts taken from the reports of the district agricultural officers in charge:—

(a) *Maswa.*

"Mwasita Seed Farm.—This farm was used mainly for the production of feterita millet. An October dry-sown crop which germinated about the 20th of that month was harvested in February. A yield of 473 pounds per acre over 35 acres was obtained, and the value of this seed crop (based on the cost of importations from the Sudan to Kwimba and Musoma) at Shs. 21/- per bag paid for the cost of running the farms at Mwasita and Shanwa. Other main crops planted at Mwasita were Virginia (Union) bunch groundnuts and Argentine yellow maize. Low yields were obtained from these crops but marked improvement was shown on surrounding native cultivations, which were a comparative failure.

"Dam construction has formed part of the work at Mwasita during the year. Ploughs and dam scoops have been used for the greater part of the work. The excavated area of the dam will be approximately half an acre in extent when completed, and it is intended to store five acre-feet of water. At present some two acre-feet of water has been impounded, and this will feed a deep water-hole excavated at one end of the dam. The dam is to have two water-holes—one at each end—to allow for alternate watering and cleaning during the dry seasons.

"Shanwa.—The farm and school garden has been used mainly in conjunction with the dairy herd. At Shanwa mixed farming and anti-erosion methods have been demonstrated for the past three seasons, and the farm has responded to the treatment bestowed on it.

"Anti-erosion measures now adopted as the result of past experience at Shanwa are: (i) narrow base contour ridges on all types of land subject to erosion where ploughs are to be used; (ii) tie ridging between contour ridges—as an additional safeguard where hand cultivation is to be used. Tie ridging appears to be particularly useful in conserving rainfall, weed mulch and leaf fall for the benefit of the crop.

"An area of grassland approximately 150 acres in extent has been taken in hand and has already responded to resting, rotational grazing and simple anti-erosion measures. Bare patches have been covered by thorn bushes and erosion gullies have been allowed to grow a thick grass cover where possible. Further development is now taking place with contour ridging, and fifty acres of land have already been protected.

"The rotational grazing trial which is being conducted by the Pasture Research Officer is situated on the above-mentioned area of grassland, and on an area of *mbuga* grazing at Mwasita. One acre of *mbuga* grazing has carried a beast through the rains and early dry season, while three acres of poor upland grazing have carried a bullock through the last half of the dry season and during the early rains. The bullocks maintained condition throughout and at the end of the year were prime fat.

"Fodder crops: Fiwi beans, sunflowers and Sudan grass were grown as fodder crops. Sunflowers provided a bulky fodder which was eaten by penned cattle when either in the green or dry state. Sudan grass was catch cropped on land intended for tobacco and produced a fair amount of good quality forage and seed. Dolichos beans (Fiwi) again proved the most valuable crop, mainly on account of its drought-resistant qualities which enable a crop to be maintained for the production of forage at the end of the dry season and the beginning of the rains when most required.

"Pennisetum and sunn hemp were grown as green manure crops but, owing to the drought in February and March, the turned-in crop probably did more harm than good.

"This season Pennisetum-Sunflower-Fiwi mixture has been grown for folding. It is thought that the Wasukuma stock owners might take up night-folding—on bare fallows if a decided advantage can be shown to accrue from the practice—and a few trials will therefore be made this season in order to gain information as to the best methods to be adopted, after which a properly laid out experiment can be devised if necessary.

"Shanwa School Farm.—The Shanwa School farm comprises six and a half acres, of which a plant museum of twenty one-tenth acre plots occupies two acres, a four course rotation plot two acres, while the remaining two and a half acres are available for various types of cropping.

"Conditions at Shanwa were particularly bad during the months of February and March, and pennisetum and cotton were the only main crops which came through with any success. The rotation adopted at Shanwa last season is given below:—

1st Year	...	Green Crop. For Green Manure, Compost or Folding. Followed by a catch crop, Feterita (*Tepary; or forage*).
2nd Year	...	Cotton.
3rd Year	...	Wilu Sorghum, Pennisetum mixture or Maize and Beans.
4th Year	...	Groundnuts (native), or Virginia Bunch followed by Tepary.

"The above rotation has been devised to suit the light soil type. When the land has attained a fair state of fertility it is proposed to dispense with the green crop and introduce an extra cereal crop, or preferably sweet potatoes as a root crop. It proved a failure last season owing to the fact that the green crop when turned in refused to rot through drought, maize was a complete failure, groundnuts were left for February planting and poor planting weather resulted in a low stand. Cotton withstood the drought and a bad aphis attack and made a yield of 256 pounds per acre.

"Amongst the one-tenth plant museum plots, cotton and awned bulrush millet were the only crops which gave a return of any value. Yields on land manured with yard manure were equivalent to 420 pounds per acre cotton, and 905 pounds per acre millet. During the present season excellent progress has been made by all crops.

"The schoolboys at Shanwa have had experience in the following subjects:—

(i) Milk recording.
(ii) Fodder crop cultivation and soiling.
(iii) Farmyard manure manufacture and disposal.
(iv) Seed disinfection—sulphur dusting.
(v) Anti-erosion work—tie ridging—contour ridging.
(vi) Green manuring.
(vii) The keeping of field notes.

The smaller boys naturally take little notice of what is going on but many of the older boys become very interested."

(b) *Tabora.*

"School gardens have been maintained at Ndomo (Nzega) and Zongomera (Kahama) native administration schools. These consist of five half-acre plots comprising a five-course rotation, and one-fortieth-acre individual boys' plots planted up with as many different kinds and varieties of crops as are obtainable. These latter plots are also used to show differences of yield and quality due to time of planting, seed selection, and method of cultivation.

"Seed farms have been maintained at Ndomo (native administration) and Kazima (prison farm). The latter is also used for trial and teaching purposes. In connection with the Ndomo farm two ploughing teams have been made available exclusively for hire by natives during the 1934-35 season at Shs. 2/50 per plough per day. This innovation has proved highly successful and the demand is well in excess of the supply. Arrangements are being made to extend this practice—possibly on different lines—next season. Provision is also being made for a supplementary food supply for the oxen prior to the opening of the ploughing season.

"The surplus seed from all these farms and plots was distributed to local natives through the native authorities on a non-returnable basis."

(c) *Biharamulo.*

"Demonstration of the culture and preparation of such crops as maize, groundnuts, beans, cassava, coffee, tobacco, etc., have been available at Ntungamo seed farm. Anti-erosion measures and green manuring have also been demonstrated. Large quantities of the produce have been eagerly sought by natives and distributed to them. It is as yet impossible to judge the effect of the above demonstrations."

(d) *Shinyanga-Lubaga.*

"An area comprising 30 acres of land was earmarked for experimental purposes, and 205 acres were planted with bulk crops to provide seed reserves for the native administration. In addition 24 acres were late planted with maize for the making of ensilage and produced sufficient green material to fill four pits each with a cubical capacity of approximately 1,700 cubic feet. An excellent and adequate food supply was thus made available for the ploughing oxen during the dry season.

"Net profit handed to the native administration during the current year totals to date over £150, making an average profit for the four years during

which Lubaga has been in existence of over £120 per annum. Additional profit for this year is also represented in the considerable tonnage of groundnuts, maize, millets and other seeds still in the stores and available for sale or free distribution to native cultivators."

Ploughing.

25. On all farms, with the exception of Tabora, ploughs are used to cultivate the land, and facilities are provided to break in oxen and train natives in the use of ploughs. The natives are keen and quick to learn, and if progress in ploughing is slow it is not because the native does not realize its value but because of other factors—initial cost of the plough, equipment and oxen; or if he possesses oxen he is afraid to work them as they are usually in a deplorable condition at the beginning of the ploughing season and cannot stand up to the work.

26. If Government or the native authorities are willing to plough up land for native cultivators they usually cannot compete with the demand. Two shillings to two shillings and fifty cents per day is easily obtainable for the hire of a plough, ploughman and two oxen. This undoubtedly appeals to the native as he has no capital outlay, no worry regarding upkeep of equipment or supplementary feeding for oxen and no risks. The only real advantage of this system is that it extends our ploughing demonstrations and yields a certain amount of revenue to the native authority farms.

Native Holdings.

27. Reference was made in the last annual report to the evils of soil erosion, over-stocking, shifting cultivation and the impoverishment of soils in our settled areas, and it was suggested that a practical solution to the above problems lay in the establishment of a class of native small holders who would farm the land according to the rules of good husbandry, i.e. maintain the land clean and in good state of cultivation and fertility by adopting such methods of farming as have proved successful on our experiment stations and demonstration farms.

28. The two model holdings at Ukiriguru were a source of interest to all concerned. It was realized that the human factor was all-important. What has been proved by experiment to be sound might well fail in practice owing to the lack of ability or desire on the part of the individuals, so a departmental holding was run as a control or check. We were undoubtedly fortunate in our choice of peasant because both the holdings proved on an average more successful than the control. In spite of an exceptionally dry season they maintained their stock in excellent condition, provided ample food for their needs and in addition obtained a substantial cash return for their labours.

29. The District Agricultural Officer, Mwanza, describes the results of the Ukiriguru holdings as follows:—

"The size of the holdings originally marked out for the settlers was eight acres and in addition there was approximately four acres of grazing to each holding. During the year it was decided to increase the size by a further two acres each in order to allow additional plantings of root and fodder crops so that the final plots were ten acres of arable land and four acres of grazing. The soils vary from a heavy black type to a medium sandy type, the Bukumbi holding having a greater proportion of light soils than the Urima holding.

"The arable land was divided into acre blocks, on one of which was built the house, cattle boma, etc., and the remaining part of the block was planted with fruit trees and permanent fodder plants. The land was cropped as follows :—

Block 1 : House, fruit trees and fodder crops.
,, 2 : Cotton
,, 3 : Sorghums
,, 4 : Groundnuts
,, 5 : Millet
} Rotation Millet manured.
,, 6 : Maize and Tepary Bean
,, 7 : Fodder crops (Fiwi, Millet, Mucuna)
,, 8 : Root Crops (Sweet potato, Cassava)
,, 9 : Fodder
,, 10 : Not cultivated.

"Before examining the figures given for cultivation and the returns it should be recorded that the first year has been a difficult one for the settlers. They have had to break in a great deal of new land, they experienced an extremely dry year and at the same time carried out a number of new practices such as stall feeding and bedding down their cattle, growing of fodder crops, etc. Against this they have been constantly visited, encouraged and advised, and there can be little doubt that the interest shown in them has helped tremendously in their success. Had this not been given they would not have shown half the energy they did.

Summary of Yields of Food and Cash Crops.

	Sorghums	Millets	Maize	Groundnuts	Cotton
Urima ...	270	577	607	35	584
Bukumbi ...	530	420	820	203	248
Control ...	621	414	Fodder	262	323
Average ...	477	470	713	166	385

Total grains : 1,660 lbs. Cash crops : Shs. 43/10.
Sweet potatoes, cassava, green maize and beans were harvested as required.

"In addition to the cash received for the sale of crops, the two farmers received an average of Shs. 33/10 from the sale of milk which gives an average income of Shs. 76/20. Eight tons of manure were produced, in just under the year from five head of cattle ; this was applied to the millet and fodder crops. It will be a number of years before it can be seen if this is sufficient to maintain fertility at a high level but a green manure crop can be fitted into the rotation if found necessary.

"The total time spent by the house unit, that is the man, his wife and helper on the Urima holding was 322 days, an average of 107 days per person. This does not include the time spent in attending to the stock or marketing produce. On the Bukumbi holding the time spent was much less ; being 267 days, an average of 89 days per person. The figures indicate that a family unit of three can cultivate ten acres with ease provided they keep well ahead with their early cultivation and planting which is the most important and busiest time.

Summary.

(1) A holding of ten acres of arable land can be worked by a family unit of three without undue effort.

(2) The fact of having all cultivated land close to the house is a great factor in enabling increased acreage to be cultivated.

(3) The ten-acre holding even in a bad year is sufficient to supply ample food and cash crops. In a good year a desirable state of plenty should ensure.

(4) A small acreage of individually owned grazing when supplemented with properly conserved roughage from the arable land can maintain a large number of stock in good condition.

(5) The quantity of properly made farmyard manure available coupled with a rotation of crops should maintain soil fertility at an economical level.

(6) Native cows show a marked response to housing and feeding and become valuable milk producers.

(7) The native cultivator, provided he is supervised at first, soon appreciates the advantages of such methods and has shown a steadily increasing keenness and understanding."

30. In the Shinyanga District two demonstration holdings have been established at Lubaga and two at Ibadakuli while resettlement on the above lines has taken place at Buhungukira and Uzinza where sixty and thirty-two holdings respectively have been established.

31. Although we are confident that an eight to ten-acre holding is sufficient for the present requirements of a native family of three working units where the number of stock is limited, there are so many variable factors in farming which are beyond our control that it is considered advisable to hold ten acres in reserve to provide building material and fire-wood and allow for expansion if and when economic circumstances so dictate. Therefore the ideal area is a twenty-acre block.

Nyakato (Bukoba) Agricultural Training Centre.

32. Mr. A. E. Haarer, Agricultural Lecturer in charge, proceeded on vacation leave on the completion of the two-year course and was relieved by Mr. H. Gillman, District Agricultural Officer, on 1st December. Mr. Haarer's report is attached.

Cotton Seed Distribution.

33. Seed requirements were prepared for each district, giving full details of the amounts required at each distribution centre, and submitted to the ginners who were responsible for supplying and transporting the seed. This arrangement proved unsatisfactory and it was a case of everybody's business being nobody's business and the onus fell, as in former years, on the officers of this department.

34. The amounts of cotton seed distributed were as follows :—

		Tons			Tons
Uganda Upland:	Mwanza ...	825	U/4/4/2:	Shinyanga	272
	Maswa ...	650		Kahama	90
	Bukwimba ...	524		Northern Nzega ...	90
	Musoma ...	215			
	Tabora ...	228		Total ...	452
	Shinyanga ...	15			
	Total ...	2,457			

35. In addition to the above, the following amounts of Uganda Upland and U/4/4/2 seed were railed for distribution outside the Circle :—

		Tons			Tons
Uganda Upland:	Ruvu ...	20	U/4/4/2:	Kenya	25
	Ngerengere ...	40			
	Morogoro ...	35			
	Soga	10			
	Dar es Salaam	100			
	Pugu... ...	70			
	Lindi ...	200			
	Kilwa ...	100			
	Total ...	575			

Marketing Improvement and Extension.

36. The system of regulated markets to control the sale and purchase of native produce which was tried out in 1932 and 1933 was this season established on a uniform basis in the Mwanza, Kwimba, Shinyanga and Musoma districts. Uniform bye-laws were applied to all markets and the sale and purchase of groundnuts, rice, sesame and gum arabic were controlled. Thirteen produce markets operated in the Mwanza District, ten in Musoma, eight in Bukwimba, seven in Shinyanga and five in Maswa.

37. In the Western Province regulated markets controlling the sale and purchase of groundnuts, rice, beeswax and gum arabic functioned successfully in the Kahama and Kigoma districts and proved popular with the natives, whereas seven markets in Tabora District and two in Nzega proved a failure as natives were allowed to sell in either markets or shops, and the traders, very naturally, did not patronise the markets but preferred to purchase the produce in their shops.

38. The quantities of produce in tons which passed through the markets during the period they operated are given below :—

DISTRICT	Groundnuts	Average price in cts. per lb.	Rice	Average price in cts. per lb.	Sesame	Average price in cts. per lb.	Gum	Average price in cts. per lb.
Mwanza ...	598.51	3.80	1,598.81	4.70	11.25	4.00	1.17	5.00
Bukwimba	572.22	4.25	327.49	4.44	3.62	3.50	102.27	10.75
Maswa ...	289.82	3.50	.66	3.00	1.95	3.50	1.95	8.00
Shinyanga	463.96	4.04	—	—	—	—	327.10	8.75
Musoma ...	38.57	4.00	335.69	5.00	41.69	4.00	—	—
Total ...	1,963.08	3.92	2,262.65	4.28	58.51	3.75	432.49	8.12

39. In spite of adverse criticism levelled at the system it has undoubtedly proved a success and has gained popularity with the natives. In time it is hoped to establish special market days in the principal trading centres. This can best be achieved by a regular system of inspection. For example, if the natives know that an officer will be present during the season at Musungwe on Mondays, Kissesa on Tuesdays, Nyanguge on Wednesdays, etc., they will be attracted to these markets on those days and they will come to be regarded as the market days for those particular centres. This will have definite advantages as it will speed up marketing and attract more buyers.

40. The Biharamulo crop of Heavy Western tobacco was marketed as in previous years by the department assisted by the Biharamulo Agricultural Society.

41. Cotton.—Last year's marketing system was followed and the crop was sold at cotton markets, cotton (ginners) markets and tender posts. Fair prices were promulgated by the Director of Agriculture and it was an offence to pay less than these. On the other hand, if the buyer paid less than the price he advertised but an amount equal to or above the fair promulgated price it was a breach of contract, and the natives' only redress was to take a civil action against him.

42. Owing to the failure of the rice crop and the unattractive prices offered for groundnuts the natives eargerly awaited the opening of the cotton markets. When they realized that thirteen to fifteen cents per pound was being offered for 1st grade a veritable panic ensued and continued for a week. Thousands and thousands of natives flocked to the markets and buyers could not cope with the rush. Stores were filled in a day and mountains of cotton rose up behind each store, the fleet of lorries being unable to compete with the quantity. The banks ran short of money and buyers travelled as far as Tabora to borrow money in the bazaars at five to ten per cent. more than its value. After the first fortnight things became more normal but by that time 65 per cent. of a 26,000-bale crop had been purchased.

43. The marketing staff was transferred from produce markets to cotton markets but, except in the Maswa District where they were closely supervised, the amount of assistance they were able to render to the natives during the rush period was negligible.

44. The District Agricultural Officer, Maswa, reports: "Chicanery seems to be an essential part of cotton buying, and only the very strict supervision employed here enabled the seller to obtain the prices offered by buyers." In this district (Maswa) the native authorities set up weighing booths outside the precincts of the markets and sellers were provided with chits stating the net weight and value of loads. Until such time as Government or native authorities provide adequate staff to apply the above system to all markets, and to grade, weigh and check the cash received, the marketing of the crop cannot be termed satisfactory.

45. In order to keep the U/4 seed free from admixture movement from Shinyanga District was prohibted. The crop was purchased as in the previous year by Messrs. Bhagwanji Sunderji and Company, who rent the ginneries in the Shinyanga District. The U/4/4/2 crop, of approximately two thousand bales, changed hands at an average price of eleven cents per pound for first, nine cents for second, and six and a half cents for third quality seed-cotton.

46. The Uganda Upland crop of 24,000 bales was purchased at an average price of twelve and a half cents per pound for first and seven cents for third quality seed-cotton.

Coffee Inspection and Grading.

47. Although grading is optional, practically the whole export crop was graded, thus indicating the importance the trade attach to a government grading certificate and being a testimony to the efficiency of the grading staff. Bags passed for export were 116,309 of which 706 bags were G.A.Q. and 1,108 bags Triage, the remainder being F.A.Q.

48. On an average the Arabica crop fetched £5 per ton and the Robusta £2 4s. per ton more than in the previous season. The total crop exported was 10,209·54 tons as compared with 7,922·08 tons in 1933.

49. In connection with crop production one must refer to the acute shortage of land in many areas of the Lake Province. The density of population in the Nyanza Federation is approximately 126 per square mile and in the chiefdoms of Beda, Mwanza, Nyegezi, Ibanda and Bukumbi, which comprise a total area of 230 square miles, it is as high as 210 per square mile. Quite a large portion of this area is occupied by rocky knolls thus making the concentration of natives on suitable land very considerable.

50. Existence of stock is becoming more and more precarious and the number of landless youths in these areas is ever increasing. Furthermore, the capacity of the existing cultivators in many cases is definitely restricted through lack of land.

51. *Coffee.*—Bukoba : For the past three years the activities of the department have been directed towards improvements in field sanitation and preparation of the crop for market. The increase in output and the fact that not one single bag of coffee was rejected in the grading sheds on account of its moisture content speak volumes for the progress made and reflects great credit on the chiefs and native authorities of Bukoba.

52. Last year's export crop was a record but this record has been beaten by over two thousand tons this season. It has been calculated that only ten per cent. of this can possibly be due to the increased plantings which have taken place during the past five years; that being so the increase must be credited to the success which has attended disease control measures, particularly the campaign against *Stephanoderes*, and to general improvements in field conditions. The district agricultural officer reports: "the only appreciable increase in coffee plantations has occurred in Ihangiro and Western Kianga, where immigrant Wasubi and Wanyaruanda are breaking new ground. Their plantings consist almost entirely of Arabica which does better there than Robusta."

53. The following table gives comparative export figures in tons :—

	1930	1931	1932	1933	1934
Robusta ...	4,660·3	4,848·1	5,705·9	5,054·02	6,898·50
Arabica ...	2,708·4	1,738·3	1,401·2	2,868·06	3,311·04
Totals ...	7,368·7	6,586·4	7,107·1	7,922·08	10,209·54

54. Bugufi : A steady increase in cultivation is recorded and 356,800 trees have been planted to date. The industry promises well and a small crop of approximately two tons was reaped this year.

55. Biharamulo : Coffee cultivation is extending to specially selected areas of this district. Forty pounds of Bourbon coffee seed has been obtained from Moshi and six nurseries have been started. The two-year-old coffee planted as a trial and for demonstration purposes at the Ntungamo seed farm is progressing well.

56. Coffee is also grown to a limited extent in the Kibondo and Kasulu areas of the Western Province. In Kibondo it cannot be considered a success but that in Kasulu is favourably reported on by the district agricultural officer who states : "the coffee at Kasulu appears to be healthy and yields a fair crop showing a response to proper treatment and choice of locality."

57. *Cotton.*—Cotton has again proved its drought-resisting qualities and its popularity shows no signs of waning. The early rains were favourable

and, the planting of rice and groundnuts being curtailed owing to drought, the natives devoted their energies to increasing their cotton plantations. Results exceeded all expectations and record crops were harvested in most areas. Cotton-growing was revived in the Kahama and Nzega districts and trial plots were laid down in Tabora. A severe epidemic of internal boll disease had disastrous effects on the crop, but in spite of this a cotton-planting campaign on a large scale has been launched.

58. Stores at the ginneries proved quite inadequate to accommodate the crop, and unfortunately no reliance can be placed on the purchase returns submitted by buyers until they are checked against deliveries at the ginneries. Cotton is still coming in from markets and ginning will continue until March.

59. The following figures give the approximate amounts produced in each district : Mwanza, 12,000 bales ; Maswa, 5,836 bales ; Bukwimba, 5,500 bales ; Musoma, 500 bales ; Shinyanga, 2,000 bales.

60. Taking into account ginning returns and the amount of seed-cotton remaining, the total crop should reach approximately 26,225 bales.

61. *Groundnuts.*—An endeavour to extend the cultivation of this popular crop was defeated through no fault of those concerned. The dry weather prevailing in January and February curtailed the planting period and seriously affected yields. It is the main crop of the Tabora, Kahama and Nzega districts, and in spite of low yields in many cases and which in some areas amounted to a complete failure they managed to produce a crop of 5,000 tons showing that the increase in acreage over the previous season must have been very considerable.

62. No accurate figures of production can be given as the prices offered failed to attract the natives, who preferred to keep their crop for food rather than sell it. Export figures from Maswa were the lowest on record while those of Shinyanga fell from 4,105 to 842 tons.

63. Disease and drought marred the success of an endeavour to establish groundnuts in the sleeping sickness concentrations of Uha, where a free issue of twenty tons of seed was made, and natives in all areas who depended on this crop for their cash requirements fared badly. As a result of this a considerable amount of propaganda has been necessary to persuade the natives to maintain acreages under this crop.

64. *Rice.*—This is an important crop in the lake shore areas of Mwanza and Musoma and in the swamps of Kigoma. Its production in the hinterland is gradually falling off owing to the successive failure of the rains.

65. Under the measures taken to improve this crop free issues of seed have proved unsatisfactory, and a less costly system of nurseries with the consequent issue of seedlings has been substituted.

66. The acreage under rice in the Kigoma area was considerably increased and, owing to poor crops in other parts of the territory, ruling prices were good. Exports from the Western Province amounted to 1,431 tons of rice and 530 tons of paddy, whereas in the Lake Province they fell to 1,067 tons of rice and 918 tons of paddy.

67. *Tobacco.*—The cultivation of this crop on an extensive scale has been confined to the Biharamulo District. It has proved itself the most suitable if not the only economic crop for this area, and the energetic campaign conducted by the district officer (Mr. A. Wyatt) resulted in a production of twenty tons of Heavy Western tobacco as compared with two tons last season.

68. *Sesame.*—This crop is of minor importance. Attempts to better the quality by importation of improved seed have met with little success.

69. *Root Crops.*—The value of the sweet potato and cassava crops cannot be over estimated. Their cultivation was advised as an anti-locust measure and the planting of a sufficient acreage is now enforced by the native authorities as an insurance against famine. Cassava has played an important part as a cash crop in the Western Province and large quantities have been exported.

70. *Cereals.*—Sorghums and millets are the staple food crops. Drought reduced yields considerably and food shortages and famine conditions prevailed in a number of areas. Quantities of Feterita sorghum seed were imported from the Sudan by the native authorities of Kwimba and Musoma. This variety matures in ninety days and can be planted either before or after the normal crops. Its value as an insurance crop is described by the District Agricultural Officer, Maswa, as follows :—

"People in the areas of West Nunghu, Kigoku Chiefdom, and West Mwagalla were required by a native authority order to grow half-acre plots of Feterita millet. This measure proved a great success, and cereal food was available for the relief of persons suffering from food shortage caused by the drought of 1933. Some 970 plots were cultivated and after harvest the variety received the Kisukuma name of 'Kipiji wa Ngpina,' which interpreted means, 'The Orphans' Saviour.'

"In the present season 1,650 households have been supplied with Feterita seed for early planting; the seed has been supplied to persons in receipt of famine relief in South and South-east Mwagalla."

71. *Beeswax.*—Unfavourable conditions caused a falling off in the export of this valuable product. In co-operation with the Entomologist the work of collecting and preparing the wax was encouraged in all areas. About six and a half tons were exported from the Lake Province and 232 tons from the Western Province.

72. *Gum Arabic.*—Considerably more interest has been displayed in this industry, and the protection of gum-bearing trees is now receiving the attention of Government and native authorities. For many years this has been a particularly important industry in the Shinyanga District. The total exports from this circle amounted to 1,598·5 tons, of which 1,033·5 tons was exported from Shinyanga.

Pests, Diseases and Vermin.

73. *Cotton.*—In Mwanza and the South Simuyu area of Maswa cotton suffered from a severe aphis attack during the months of March and April. In western Maswa and Shinyanga large areas of young cotton were eaten off by hairy caterpillars which necessitated replanting. The cotton in all areas was remarkably free from the "leaf curl" disease reported in previous years. Internal boll disease (*Nematospora* sp.) was responsible for the failure of the cotton crop in Nzega, Kahama and Tabora areas. It is suspected that the disease was transmitted by the Pentatomid bug, *Calidea bohemani.*

74. A heavy infestation of pink boll-worm (*Platyedra*) was discovered on the kidney cotton plants growing wild in the Kigoma area.

75. *Groundnuts.*—A disease identified as *Cercospora personata* and also rosette disease were in a large measure responsible for the failure of the groundnut crop in the Uha concentrations.

76. *Cereals.*—Smuts and downy mildew were prevalent in sorghums and millets. The use of sulphur-treated seed is gradually extending in an

endeavour to control grain smut. Although striga was less noticeable—probably owing to the dry conditions checking its growth above ground and preventing flowering—it still made a heavy drain on cereals; active anti-striga measures were continued. Stalk borer was prevalent in all areas and damage done to the sorghum crop was considerable. Large acreages were completely ruined by this pest. The larvae of the Hessian fly caused considerable damage to late-planted crops and derrisol was effectively used by the District Agricultural Officer, Maswa, to control this pest.

77. *Coffee.*—The main pests in Bukoba are the coffee bean borer (*Stephanoderes* sp.) and the coffee bug (*Antestia* sp.). Active control measures taken against *Stephanoderes* proved fruitful.

78. *Cassava.*—A heavy infestation of "leaf-curl" was general on all cassava plantations. Trials continue to be made with selections showing resistance to this disease.

79. Pigs, porcupines and baboons took their usual toll of crops. Elephants were again troublesome in Meatu and East Mwagalla. Control measures against Thomson's gazelle have been instituted in the Maswa District.

80. *Locusts.*—The following extracts from the district agricultural officers' reports are given :—

"(a) Western Province : Red locusts laid in all districts during the 1933-34 season. Ovi-position was extensive all over Nzega District and in parts of Tabora, Kahama and Ufipa. Organized hopper campaigns were carried out in Nzega, Kahama and Tabora under the direction of Europeans seconded from the King's African Rifles, Police and Education departments. Much of the time of administrative and agricultural officers was also spent on this work. Anti-locust measures consisted of trenching, beating and poison spraying. The damage to standing crops was negligible owing to the thoroughness and vigour with which the hopper campaign was conducted, but the fact that so many natives were engaged in locust operations had some effect in reducing the possible acreage of plantings and also affected the thoroughness of subsequent inter-cultivation.

"Migratory locusts laid on a small scale in the Kibondo District in January, 1934, but this species was not observed elsewhere in numbers till the latter part of the year, when small flights were seen in various parts of the Tabora District. Small bands of migratory hoppers were observed in several areas of Tabora and Nzega districts in December, 1934, but nowhere was the infestation reported to be heavy.

"From May onwards swarms of red locusts were reported from all areas, and towards the end of the year the size and frequency of these swarms had greatly increased all over the eastern part of the province. Indications are that the hopper infestation in 1935 will be heavy in Nzega, Kahama and Tabora, but at the end of the year no laying had so far been reported.

"The native administrations have contributed £200 towards the cost of zinc banding for hopper control, and nearly two miles of this are now available in the province. Owing to demands in other parts of the territory none of this material was available last year until the latter end of the campaign.

"Natural control of locusts was not conspicuous or of much importance. Besides a small degree of control exercised by birds, blow-fly maggots and the fungus *Empusa* sp. were recorded in a few areas.

"(b) Lake Province, Mwanza.—Swarms of locusts appeared in July and a certain amount of damage was done to cotton and rice. Most grain crops were well advanced and it was possible to harvest with little loss. An

increasing number of swarms were reported towards the end of the year and egg-laying took place in Southern Urima in December.

"Maswa.—The red locust laid in almost all sections of the district, but it is gratifying to record that delayed hatching, drought and parasites controlled the breeding of the pest and hoppers caused little trouble. Anti-hopper control was conducted in the chiefdoms of Mwagalla, Meatu, Ntussu and Ututwa.

"During the present season the district has again been invaded by fliers, and the outlook is again fraught with danger. Protective measures in the way of root crops are happily far advanced for the time of the year, but any destruction of early cereals such as maize or Feterita will deal a severe blow to the cultivator who is short of food.

"Bukoba.—No egg-laying occurred during the year under review, and no expenditure was incurred. Scattered bands of red locust hoppers discovered in Karagwe during May were promptly and effectively dealt with. A few mature swarms of this species passed through the district during September and October, flying in a general direction northward. No serious damage was reported.

"Biharamulo.—Egg-laying took place throughout the central and southern parts of the district early in the year and an overwhelming invasion of hoppers from Belgian Urundi of South-west Bugufi took place in January. Natives under instruction confined themselves to protecting their crops during the earlier months. Hopper emergence was general in Biharamulo (South and Central) in March and was dealt with by the native population as and where possible and necessary. In June surviving hoppers took to flight but were largely destroyed by early grass burning. Since June small scattered swarms, have appeared from time to time in the district but there has been no extensive invasion or infestation. Damage to crops during the year has been surprisingly slight and there has been no food shortage due to locust damage."

81. There is every indication of an extensive campaign against locusts being necessary next season as mature swarms are reported from all areas of the Lake Province.

Agricultural Shows.

82. These shows are now a feature of the year. Originally they were confined to Maswa and Kwimba but they have gradually extended, and this season each district in the Lake Province staged a show. The extraordinary enthusiasm and interest they arouse amongst Europeans and natives alike are sufficient proof of their popularity.

Conclusion.

83. One can review the results achieved in the past year with no little degree of satisfaction, and I think tribute is due to all officers, chiefs and native authorities for the zealous and efficient manner in which they have so loyally co-operated to assist the natives on their path of progress.

A. S. Richardson,
Senior Agricultural Officer,
i/c North-Western Circle.

ANNUAL REVIEW OF THE SOUTH-EASTERN CIRCLE.

Lindi Province.

The year's record is one of steady and substantial progress. There have been climatic setbacks, locust damage, a low level of produce prices, no capital expenditure and the usual heavy charges for inadequate transport services; but the primary producers, the native population and the sisal estates alike, have met each adversity with new endeavour. In practically all produce items the level of previous years has been well maintained, and in some, new high level records have been reached.

2. The circle review for 1933 gave an outline of the economic spheres within the circle, and explained the policy of concentrating directed effort in the remoter areas on products of high value which offered some chance of profitable disposal, such as tobacco, coffee and beeswax, while maintaining adequate internal food supplies with sufficient reserves, so that the areas need never require external relief and thus be an additional burden on the Central Government. In the coastal districts where all surplus is saleable an increase in any commodity is a net cash gain, and an increase in each and every commodity continued to be the aim. Particular attention was paid to cotton, sesame, groundnuts and rice.

Inland Area.

3. *Songea District.*—It has only been possible for the department to take an active part in the development of Songea District; no staff has been available for Tunduru and Liwale. In Songea considerable attention over a period of years has been paid to the development of a native tobacco industry, and departmental attention has also been devoted to coffee growing in the Matengo Hills.

4. *Tobacco.*—The progress made is reflected in the following production :— 1930, 830 kilos; 1931, 855 kilos; 1932, 1,897 kilos; 1933, 6,537 kilos; 1934, 32,608 kilos. In 1933 production was carried beyond the experimental stage and the success obtained by the more experienced growers gave a great stimulus to production in 1934. The arduous work of demonstrating the possibility of profitable production has now been accomplished. A nucleus of trained growers has been formed, and there is every hope of continued development. It has been the aim to teach individual natives to grow and cure tobacco well, at a profit to themselves and indirectly to the district, rather than to attempt to increase tobacco production by widespread but possibly unprofitable cultivation. This is illustrated by the increase in the average production per grower, and his average cash receipts, rather than the increase in the number of growers.

	1930	1931	1932	1933	1934
Number of growers	600	137	236	357	897
Average production	1·5kgs.	7	8	18	36·25
Average cash receipt	-/90	2/56	3/40	8/63	16/61

5. During the year four tobacco demonstration farms were maintained. Demonstrations of the various operations in tobacco culture were held frequently, and native growers paid constant visits to the farms to observe the

methods employed. The actual labour used was tax-default labour, and the full amount of tax was recovered by the sale of cured leaf. The labourers worked on an average of only seven days per month until they had completed their cards. This procedure was adopted to allow each man to work for a few days at a time at each phase of culture, and so become acquainted with the entire process, with as little interference as possible with his own cultivation and domestic life.

6. Government tobacco nurseries supplied seedlings to growers. There were twenty-four nursery centres and about 6,000 yards of nursery beds. A number of native growers maintained their own nurseries. The raising of seedlings by Government is gradually being superseded by allowing growers to prepare their own seed beds. For the 1935 season forty government nurseries have been planted and 1,836 individual growers have prepared their own nurseries. The government nurseries are mostly in new areas and are an insurance against possibly faulty native nurseries.

7. The Agricultural Assistant, Songea (Mr. Twells) to whose energy the success of the 1934 crop is largely due, reports :—

"The native attitude toward the tobacco crop is now in the nature of a 'gold rush,' and it has been considered necessary to institute a certain measure of control (i.e. for 1935). One thousand eight hundred and thirty-six natives have prepared their own nurseries and have been issued with tobacco seed only sufficient for the planting of half an acre each, and only when their nurseries have been approved. It is anticipated that the native growers will number 3,000 to 4,000 in the coming season, and that the crop will exceed 100 tons."

8. The absence of proper storage and baling facilities has been a difficulty with which the local officers have been faced since 1932. This season with a 32-ton crop on hand all available storage accommodation at Songea Station was requisitioned, and with the primitive baling presses and no steam conditioning the packing was a heavy drain on the agricultural assistant's time, so much so that it was necessary to transfer the district foreman (Mr. Allen) to Songea to assist. It was realized that if the 1934 crop created extreme difficulty in handling, the anticipated increase in 1935 would be impossible to deal with without improved facilities. As a temporary measure the native administration voted £250 for packing plant and buildings. The plans of a small tobacco packing factory, with flue drying barns, steam conditioning plant and storage room, were prepared by Mr. Twells and work has gone ahead under his supervision. At the end of the year the brickwork of the building was practically complete and the roof on. It is anticipated that all fitments will be ready in time for the 1935 crop. The practical assistance of the district foreman (Mr. Allen) has been invaluable during construction. The plan allows for expansion as necessary.

9. Marketing : The entire crop was purchased by Government and resold as baled tobacco. The business was carried through on a commercial basis without loss to Government and to the satisfaction of the producers. The department has marketed the crop successfully for a number of years but has always recognized that as soon as production was firmly established this would cease to be a departmental function. With this in mind, and on the advice of the Economic Advisory Board the gradual evolution of native co-operative effort has been undertaken. The principles of co-operative societies are being explained to the growers and the probable formation of co-operative societies

to handle the tobacco crop is foreshadowed as one of the main features of work in Songea for 1935.

10. *Coffee.*—In 1933 the Matengo Native Authority passed rules to regulate planting and safeguard growers. The most important of these rules was the restriction of all new coffee planting to the variety Kents. Seed of selected Kents was obtained and planted out in tribal nurseries. The Matengo people are extremely able and intelligent cultivators. It is a tribute to their sound common sense that when the position was carefully explained to them, and the arguments carried their judgment, all concerned voluntarily refrained from planting out the miscellaneous seedlings available this year and all agreed to wait for the Kents seedlings which were being raised and continue the extension of planting in 1935. This does not mean that the 1934 season was lost. Far from that, the prospective growers have carefully prepared their land to receive the seedling trees early in 1935. All planting sites were inspected and approved. Contour ridges and terraces have been prepared where necessary, pits have been dug to receive the trees and the land has been manured and cover cropped. At the end of the year there were some 18,000 trees available for planting out with the rains and over 25,000 pits already dug to receive this limited supply.

11. Such is the ability and keenness of the native farmers that it is not now necessary to rely on central nurseries. Approved group nurseries have been established to raise the bulk of next year's seedlings. Nursery provision for 100,000 seedlings has been made.

12. The small crop from the older Matengo plantings was disposed of locally to Europeans. Largely as a result of the year's instruction given to the two Matengo men at Moshi there is now arising a spontaneous desire for the formation of some co-operative organization to control marketing, to foster good cultivation and disseminate knowledge. Already these coffee growers have arranged informal meetings to discuss their problems and have built themselves a meeting house. There is a very real desire for betterment and co-operation and it is a pleasure to work amongst these people.

13. *Food crops.*—In spite of locusts the food supplies of the district were adequate. Attention has been paid to increasing the quantity of root crops.

14. *Tunduru and Liwale districts.*—There has been no departmental staff in these districts. The Senior Agricultural Officer has advised the district officers on such problems as have arisen, but direct contact with producers has been entirely through the Administration. In Tunduru a small quantity of cotton was grown and marketed to the satisfaction of native growers. In Liwale some attention has been given to the resuscitation of collection of wild rubber, and a market has been found for all that has so far been produced.

Intermediate Area.

15. *Newala and Masasi.*—No staff has been available for Newala, but Masasi has had the assistance of a district foreman, paid for and under the guidance of this department. A small crop (five tons) of Heavy Western tobacco was raised and marketed to the satisfaction of growers but with some difficulty to the department owing to the poor quality of leaf. As a result of the success of the 1933 cotton crop in Lindi the growing of cotton was extended into Masasi District. The local crop amounted to thirty tons. The rains were exceptionally heavy and late, with consequent loss to the cotton crop but gain to the grain crop. Masasi has had probably the best food year for the past ten years.

16. The famine relief work, which took the form of clearing and planting up new land to cash crops, was particularly successful in the Mchauru area. Not only has this area reaped a satisfactory food harvest but I understand that tax collection, as the result of sale of sesame and groundnuts, has been easier here than elsewhere in the district.

17. A number of model native holdings have been established. It is hoped to incorporate the keeping of cattle at a later stage. At present the object of these holdings is to demonstrate good use of each type of land, bringing a cash crop such as tobacco, cotton, sesame or groundnuts into the scheme of native farming, and where possible demonstrating the value of green manuring so as to obviate the necessity for long bush fallowing of the land, or at any rate to lengthen the period of profitable use of the land and shorten the period of necessary fallow by hastening the restoration of humus.

Coastal Area.

18. In the years before depression the three ports of the province—Kilwa, Lindi and Mikindani—evacuated a considerable amount of hinterland produce, but now, except for tobacco, beeswax and ivory, the great bulk of export produce is mainly the product of the districts which carry their names. A strenuous effort was made to maintain and increase the planting of all export crops and three district foremen were engaged to assist in field supervision. Particular attention was paid to cotton, sesame and groundnuts.

19. The record increase in sesame output brought about in 1932—still further increased in 1933—has been practically maintained in 1934, despite adverse growing conditions. The cotton crop was only prevented from being the highest on record by disastrous boll shed, due to abnormal weather, which reduced the crop by fully 75 per cent. Nevertheless, the output is not far behind last season. The efforts to increase groundnut production were particularly successful. In 1933 a 45 per cent. increase was achieved and this season a further increase of 160 per cent. over last year is recorded. Rice production continues to increase in importance, tobacco now ranks amongst major exports; only the copra industry is stagnant. The value of native produce exports now considerably exceeds estate produce.

20. A summary of principal exports (this includes shipments to Dar es Salaam and other territorial ports as well as direct exports) for the years 1932, 1933 and 1934 from ports of the province is given below :—

PRODUCE	1932		1933		1934	
	Tons	£	Tons	£	Tons	£
Sisal	6,836	68,288	7,817	89,060	8,359	86,755
Sesame	3,970	42,816	4,085	39,096	3,915	32,951
Grain (not rice) ...	1,960	8,196	1,185	4,481	5,280	23,680
Rice	848	7,885	1,291	10,309	1,458	11,891
Beeswax	62	6,555	135	12,147	131	11,062
Groundnuts ...	296	3,178	425	3,727	1,111	8,821
Tobacco	44	1,168	45	1,458	104	3,956
Cotton lint ...	10	448	175	5,218	83*	2,979
Copra	887	7,676	467	3,649	439	2,545
Gum copal ...	19	1,030	27	1,033	27	1,215
	14,932	147,240	15,652	170,178	20,907	185,855

*Cotton ginning is not complete.

21. *Sisal.*—The output in 1934 was 542 tons greater than in 1933. The steady increase in production has been maintained by estates, despite the further fall in prices. No estates have closed down. Sisal continues to be the chief single export item from Lindi and Mikindani.

22. *Sesame.*—Propaganda for increased planting of sesame met with good response; the actual acreage under crop was almost certainly the highest yet achieved, and the admixture of sesame with mtama was fairly general. The season of heavy and late rain was not favourable to yield. Washaways and waterlogging were widespread. In the case of interplanted sesame and mtama the very vigorous growth of mtama choked much of the sesame. Under the circumstances, while exports were just about maintained, the record of last year was not exceeded. Sesame maintains its place as the most valuable item of native produce exported; the export was 400 tons less than in 1933.

23. *Grain (other than rice).*—Throughout the area grain crops were good. The annual export of grain fluctuates very considerably and is not entirely dependent on production. The custom of quoting only direct shipments in trade reports instead of the total of direct and coastwise shipments is also misleading. Much depends on the dhow traffic with the Persian Gulf, the state of crops elsewhere in the Territory and the all-important factors of price and freights. This has been a good year both for internal consumption and for export. It is many years since the peoples' stomachs have been as well filled. What the weather destroyed in cash in the cotton and sesame crops has been made up in abundance of food.

24. *Rice.*—Each year rice, as a dual purpose crop—food and cash—is gaining in popularity. Unfortunately, the early rice crop was the heaviest sufferer from the locust invasion, and at one time a severe failure of the crop seemed almost certain. However, the abnormally heavy late rain and subsequent flooding brought on a late crop, particularly in the Mikindani-Rovuma flood area, and failure was turned into an excellent but locally restricted harvest.

25. *Beeswax.*—The phenomenal rise in beeswax exports reported last year has been maintained this season. The increase is attributed as before to some extent to propaganda but particularly to the low price for other produce in the interior, which has led natives to devote their energies to collecting beeswax as one of the very few profitable vocations open to them. It must also be admitted that a considerable proportion finds its way from across the Portuguese East African border and is exported through our ports.

26. *Cotton.*—The season opened with marked enthusiasm. The success of the 1933 crop, propaganda, assistance and encouragement from all officers led to the greatest planting of cotton the area has ever seen. It is estimated that the acreage in Lindi and Mikindani increased by fully 9,000 acres. Cotton seed was distributed as under:—

	1933		1934	
	Tons	People	Tons	People
Lindi	52	6,631	... 118	19,600
Mikindani	35	4,715	... 82	11,400
Totals ...	87	11,346	... 200	31,000

By May the cotton in the field had made very good growth, and to all it appeared that a real bumper record crop was in sight. But disaster was at hand. May brought nearly four times as much rain as usual, and during the

ripening months of June, July and August, instead of practically rainless weeks of sunshine, dull cloudy days and constant rain was the rule.
The crop was ruined. In the words of the District Agricultural Officer, Lindi :—

"Luxuriant growth was followed by very heavy physiological boll shed, which began in July and continued until September. Many fields were almost entirely bare of bolls and leaves in August, but afterwards threw a second flush of flowers and set a few bolls which eventually matured in November. In addition to physiological boll shed, cotton suffered severely from jassid attack."

The actual crop amounted to only 25 per cent. of the conservative May estimate.

27. The crop was purchased by Messrs. Mathuradas Kalidas at prices fixed by the Director of Agriculture. Buying was arranged at Mtua and Mikindani ginneries and at convenient buying-post centres. A flat rate price operated over the area, i.e. the same price was paid at the ginneries as at remote buying-posts.

The sales of seed cotton by natives during the 1934 season are shown in the following table :—

Native Seed Cotton In Pounds

District	1st	2nd	3rd	Total	Value received by Growers Shs.
Lindi	151,998	102,566	162,276	416,840	32,352
Masasi	30,278	19,100	17,982	67,360	5,622
Tunduru	3,432	216	132	3,780	266
Mikindani	124,615	29,445	88,031	242,091	19,342
	310,323	151,327	268,421	730,071	57,582

In addition to native-grown cotton, 50,074lb. of seed-cotton was produced on non-native estates mostly interplanted in young sisal.

28. The season's ginning is not quite completed at the time of writing, but from seed-cotton production the output should be just about 585 statistical bales, as against 981 last season.

29. The native reaction to the serious crop failure has been philosophical. There has been general satisfaction with the marketing arrangements although the picketing of markets by tax collectors caused some friction.

30. By means of demonstration plots and instruction natives are being encouraged to incorporate cotton in their system of farming, and not merely to grow cotton *kwa* cotton, or as a speculative crop. It has been shown that good use of land can be made by planting early maize and running in cotton in the ripening maize. The maize is harvested before the cotton suffers from shading. Also, on heavier wet land it is possible to grow rice and cotton in one season. Similarly, cotton fits admirably in rotation with other crops; the timely uprooted cotton field is often the earliest field ready for cultivation with the first rains of the following season.

31. *Groundnuts.*—This crop has never before been of major importance as an export crop in this area. As stated in last year's report, there has been a marked tendency, particularly in Lindi District, for natives to place absolute reliance on sesame for their cash requirements. The danger has been fully realized, and cotton and groundnuts have been pushed to create a more healthy balance. The 45 per cent. increase achieved last year has been carried

considerably further, and the export is a record very substantially ahead of the previous best year.

32. *Tobacco.*—The export of low grade native roll tobacco is not abnormal, but is above the level of the last two years. The great increase in tonnage and more particularly in value is due to the growth of the Heavy Western fire-cured tobacco industry in Songea. This has been dealt with earlier in this report. Tobacco has developed into an appreciable export, and now exceeds copra in export value.

33. *Copra.*—The copra industry is stagnant. Production is in the hands of Arabs, Indians and a class of native it is very difficult to influence. The total output from Lindi, Kilwa and Mikindani amounted to 439 tons against 467 tons last year. The bulk of the export is from Kilwa.

Experimental Stations.

34. Work at the Mpapura Experimental Station was restricted for reasons of economy to varietal trials of native food and cash crops, demonstrations and seed multiplication. The rotation trials were continued. The station fulfils a useful function as a training centre for native instructors as well.

Locusts.

35. The invasion of the Lindi Province by the Red Locust (*Nomadacris septemfaciata*) commenced on 15th December, 1933, with the advent of several swarms of fliers into Tunduru District from Portuguese East Africa. From that date many swarms entered this Territory over a front extending from the Indian Ocean to Lake Nyasa. The main flights passed out of the province without ovipositing. In all areas, however, considerable egg-laying by stragglers took place. By 9th January the campaign against hoppers had commenced, and by the end of January hatching was general in all districts.

36. The hopper bands, though very numerous, were small and widely distributed. From mid-January to mid-April organized destruction of hopper bands continued. At the beginning of the campaign there was a good deal of slackening on the part of natives in some areas but prompt action to bring the defaulters to book soon righted matters, and on the whole the response of the native authorities and tribesmen was extremely good.

37. The greatest damage was done to the rice crop. The total damage to other crops was very slight in nearly all areas. But for the response of the natives and the direction given to their efforts it would have been extensive if not serious. The cost of the campaign was Shs. 2,300/-, which expenditure was largely incurred on transport for European officers supervising work in the field. A large part of the field work was very ably undertaken by the three district foremen and the agricultural assistant, Mikindani.

38. From May to June a fresh but lighter invasion of flying locusts took place from Portuguese East Africa. A few small locally hatched ambulatory swarms were also present throughout the year, but little damage was done as most crops reached maturity in time.

39. At the close of the year a third invasion from Portuguese East Africa commenced. These locusts are mature; egg-laying is imminent and a menace to next season's crops.

Conclusion.

40. The feature of the year which has most impressed itself on departmental officers is the failure of their work and hopes for the cotton crop. But if everything is looked at in proper proportion the year should be

regarded, as it is by natives, as one of the best for many years. The economy of the province has reached some significant milestones. The total value of produce exports is up by some £15,000. The value of exports per head of the tax-paying population has at last passed Shs. 20/- per annum.

All officers have joined in the common task of increasing the production surplus above mere existence—a surplus without which the continued progress of the people is impossible. The native cultivators have themselves with their hoes borne the heat of the day, and it is to their labour above all else that their own better financial position and that of Government is due. The responsibility for directing their efforts has fallen very heavily upon the district officers, and it has been the duty and pleasure of officers of the department to share to some extent both the labour and the responsibility. But the year's record stands to the credit of the inarticulate native, and is mute testimony to his inevitable advancement.

C. K. Latham,
Senior Agricultural Officer,
i/c South-Eastern Circle.

Annexure IV.

REPORT OF THE ENTOMOLOGIST, 1934.

General.

1. The Entomologist proceeded on vacation leave on the 14th June, 1933, and returned to duty in the Northern Province on the 15th March, 1934. He proceeded to England via South Africa and returned to Tanganyika via Palestine and Egypt.

2. *Activities on Leave.*—Beira: Visit to Director of Agriculture, Moçambique (outbreak of citrus canker).

Lourenço Marques: Plant fumigation equipment.

Durban: Visit to very old coffee planting north of Verulam and to coffee blocks at Umbogintwini by courtesy of Mr. Dudley Moses, Agronomist, Africa Explosives and Industries, Ltd., Natal Herbarium (*Vangueria* spp.) and Virus Disease Laboratory (Tobacco White Fly, etc.). Visit to Cedara College (discussion of fruit fly control, wattle bag-worm, etc., with Dr. L. B. Ripley and Mr. G. A. Hepburn).

Port Elizabeth: Visit to Amanzi and Addo, Sundays River citrus area, with Dr. B. Schmid, Division of Entomology, Union Department of Agriculture (mass production of *Cyptolaemus*, method "calcid" fumigation. control of citrus mealy bug and aphis, etc.).

Cape Town: Inspection plant fumigation equipment. Cape Town Museum: examination Anthores specimens ex Natal. Visit to Simondium by courtesy Mr. H. E. V. Pickstone (deciduous and citrus fruit pests, sprayer equipment, control of citrus mealy bug, etc.). Visit to Stellenbosch by courtesy of Messrs. Mitchell, Cotts & Co. (discussion with Dr. J. T. Potgieter on work of Department of Entomology).

Palestine: Citrus pest investigation at Rehobot Experimental Station of the Jewish Agency for Palestine and visits to its field stations by courtesy of Prof. F. S. Bodenheimer and staff. Liquid cyanide fumigation of citrus pests at Haifa and Accra by courtesy Imperial Chemical Industries, Ltd. Locust control and deciduous and citrus fruit pests by courtesy of Mr. E. Ballard, the Government Entomologist, and staff.

Egypt: Date treatment and fumigation before packing, silk industry, entomological problems of field crops (*Gryllotalpa*, *Prodenia*, etc.), method of mass multiplication of parasites for field libration, locust control methods and apparatus, etc., by courtesy of Mohamed Kamal Bey and staff of the Plant Protection Section, Ministry of Agriculture.

3. In England, various agricultural and horticulturial functions were attended to meet manufacturers of insecticides and spraying apparatus. Entomological problems and field control methods were discussed with scientific workers at various institutions.

4. *Plant Importation.*—Sixty-four permits for plant importations to the Northern and Tanga provinces were issued during the year. The principal articles imported embraced deciduous and citrus fruit trees, garden decoratives (bulbs, tubers, etc.) and seeds (coffee, maize, tobacco and lucerne). *Stephanoderes hampei*, Ferr. (not yet established in our northern coffee

districts) was intercepted on two occasions: in coffee seed from the Belgian Congo and in a commercial coffee sample. The caterpillars of *Setomorpha insectella*, F. (Tineidæ) was also present in numbers in the Congo Seed.

5. *Plant Legislation.*—The Plant Pest and Disease Regulations, 1934, were published in the Supplement to the Tanganyika Territory *Gazette*, Vol. XV, No. 55 of 23rd November, 1934, Government Notice No. 130. These regulated for the destruction of *Oxyanthus speciosus*, D.C., *Randia* sp., *Vangueria* spp., *Pavetta Oliveriana*, Hiern., *Rytigynia Schumanii*, Robyns., the alternative hosts of major coffee pests. *Cremaspora africana*, Benth, falls to be added to this list in the 1935 revision.

Coffee Insects.

6. Work of determination of the wild hosts of our coffee pests has been continued with important results (see Plant Pest and Disease Regulations, 1934) and a manuscript tabulating results to date will shortly be presented for publication.

7. The years 1933-1934 have been distinguished agriculturally by a rainfall deficient in quantity and irregular as to season of precipitation.

8. Prior to and during the period of coffee blossoming and subsequently during the period of setting of the minute cherry, considerable damage has been done by a Collembolid (spring tail) *Drepanocyrtus* sp. n. (detd. by Dr. G. H. Carpenter). The considerable spring tail population could be estimated by beating the coffee primaries over white enamel trays containing a shallow layer of water. Blossom and minute cherry attacked showed brown injury and shrivelled up. The presence of much unopened injured blossom which persisted on the trees was characteristic.

9. The Green Scale, *Lecanium viride*, Green, has also been favoured by the prevailing conditions and considerable damage resulted to coffee particularly in the Arusha District. While Green Scale is usually a pest of young coffee, during the period under review old well established coffee has suffered severely. The entomophagous fungus, *Cephalosporium lecanii*, Zimm., was submitted from the wetter Usambara area and from one plantation in the Weru Weru district of Kilimanjaro but rendered only feeble assistance. Internal parasites and predators ultimately became established but not before much damage from scale and the consequent sooty mould had resulted, and it required the onset of good November rains to clear up the situation. The Coccinellidæ present were—

Chilocorus adustus, Wse.,
,, *discoideus*, Crotch,
,, *angolensis*, Crotch,
Hyperaspis senegalensis, Muls and
Exochomus ventralis, Gerst.

The three species of Chilocorus were most in evidence. The internal parasites of Green Scale were referred to in the 1931 Report (page 83, paragraph 5); the observed parasites of the 1934 scale wave have been submitted for specialist study. *Eublemma costimacula*, Saalm. (Noctuidæ), has previously been recorded as a predator of Green Scale colonies; this year *E. scitula*, Ramb. has also been reared. The decorative shrub *Tecoma stans* growing in gardens adjacent to infested coffee plantations was being killed out by the scale. Guava and citrus also showed attack. Other coffee Coccidæ: The fringed scale of coffee, *Asterolecanium coffeæ*, Newstd. was recorded for the first time in Kilimanjaro (Kibosho district). One tree only showed attack, and

that heavy. The parasite *Metaphycus lounsburyi*, How. (Encyrtidæ), was present. As has been previously reported, *Asterolecanium* can at times be a serious pest in the Bukoba area (Report 1927-28, p. 36). The citrus mealy bug, *Pseudococcus citri*, Risso, was found infesting coffee in certain blocks of two plantations in west Arusha, not a general infestation. By the return of the Entomologist from leave, the situation had absolutely cleared without action of any sort having been taken. The control factor is not as yet known. Another *Pseudococcus* (not *lilacinus*) was present with the citri colonies. Isolated examples of the following have been taken : *Cerococcus hibisci*, Green, *Ceroplastes vinsonioides*, Newst., *Ceroplastes destructor*, Newst., *Saissetia coffeæ*, Walker. *Orthezia insignis*, Dougl., is becoming unduly prevalent in the Arusha district on garden decoratives like coleus, salvia, etc., and where lantana bush is plentiful in the vicinity of coffee this soft scale readily passes over on to coffee, preferring to locate between the coffee cherry clusters. The Syrphid, *Paragus Marshalli*, Bezzi, was reared from the *Orthezia* colonies.

10. *Leaf-miner.*—This pest continues to cause anxiety. The varying qualities of the damage observed in the field indicated that more than one pest or more than one species might be present. This has been experimentally confirmed. *Leucoptera daricella*, Meyr., and *Leucoptera coffeella*, Guér., are both present on coffee but the former is responsible for the major damage. Heretofore *L. coffeella*, Guér., has been looked upon as the prevalent leaf-miner. Examination shows that *L. daricella*, Meyr., amounted in plantations subject to a miner wave in 1934 to 87·5 per cent. of the *Leucoptera* population and in less affected plantations to 62 per cent. The crest of this miner wave may be looked for November-December, and at that season parasitism for some reason which merits further study goes down. Comments of disfavour of sweetened arsenite bait have been expressed by reason of its liability to kill the parasitic insects of coffee pests. It should be here commented, however, that the normal crest of miner wave in Tanganyika occurs at least six months after the pre-monsoon arsenite/sugar baiting against antestia and with the heavy season's rains of April-May-June intervening to clear the foliage of any remaining bait.

11. Parasites reared during this year's (1934) studies from Leucoptera infested foliage have embraced the following :—

Apanteles bordagei, Giard (Braconidæ), *Elasmus leucopteræ*, Ferr. (Elasmidæ), and *Plurotropis* sp., *Chrysocaris* sp., *Atoposoma variegatum*, Masi, var. *afra*, Silv. (Eulophidæ).

Of these, the *Elasmus*, the *Plurotropis* and the *Chrysocaris* have preponderated. A late 1933 rearing included *Trigonogastra* (1 sp.) (Pteromalidæ), and *Cirrospilus* (2 spp.), *Closterocirus* (1 sp.) (Eulophidæ). Besides the above, a 1930 list of determinations included *Eulophus* sp. This *Leucoptera* material is being studied, and new species will be later described by Dr. Ch. Ferrière of the Imperial Institute of Entomology, to whom we are much indebted for this specialist assistance. Parasite fluctuation and plantation and climatic conditions influencing this will receive our further attention.

12. Opportunity was afforded to bread out stem-boring caterpillars causing failure of the growing tips of young coffee in Eastern Kilimanjaro. A moth, *Cacoecia* sp. (Tortricidæ) was reared. The incidence of the pest was not observed to be serious and there was a satisfactory parasitism.

13. The small coffee slug, *Niphadolepis alianta*, Karsch. (Limacodidæ), was to be found generally in west Arusha. The slugs of this Limacodid moth when young look like small pieces of crystalline material—whipped

table jelly or jujube of clear to apple-green colour. At this young stage they feed from the underside of the foliage in small circular holes, rather characteristic work. The slugs when fully grown are pear shaped—8mm. wide and 15mm. long—and at this stage feed in normal caterpillar fashion. Pupation takes place on the tree generally by the curling in of the edge of a leaf held by silken thread and in a firm, brownish-white, oval, silken cocoon, 8mm. × 6mm. The humming bird moth, *Cephonodes hylas*, L., is, however, the leaf-eating pest of coffee most to be feared.

14. During October-November, various rhyncophoridæ, including *Systates pollinosus*, Gerst., *Isaniris acuticollis*, Fst., etc., were present in the plantations in great number effecting a crenulation of the edge of the foliage. The effect of this damage has never been observed in the mature plantations such as to demand artificial control, but protection of young set-out coffee and coffee in the nursery with arsenate of lead may become necessary. The adult beetles can be collected during the day—hiding beneath soil level near the stem base of the coffee—and destroyed.

15. The black coffee aphis, *Toxoptera aurantii*, Boy, occasionally causes malformation of young coffee growth but as yet presents no problem requiring control. The coccinellids *Ptatynaspis kolleri*, Muls, and *P. capicola*, Crotch, have been recorded this year as useful predators.

16. Droughting and droughted coffee wood invariably proves attractive to Anthribid beetles of the genus *Phloebius*, and on several plantations numbers of coffee trees, particularly in coffee blocks adjacent to ravines occupied by tree and shrub growth suffered worst. The most prevalent species was *P. pustulosus*, Gerst. The emergence holes of this form (which are transverse to the coffee stem) vary from 3 to 5mm., and they occur at any point along the length of the coffee main stem. The working channels vary in diameter and are firmly blocked with a hard, fine, white dust. The legless grubs are pronouncedly enlarged forward (wildebeeste style), and the life cycle is one of short duration. Young coffee of under two years arrested in growth under the prevailing dry conditions was attacked at or about ground level and killed out. In favourable seasons and coffee in satisfactory growth phloebius is rarely seen.

17. The minute shot-hole borer, *Xyleborus morstatti*, Haged., was submitted attacking twigs of *Coffea robusta* in the Handeni district. A more important record, however, was the finding of this pest for the first time in Kilimanjaro (Marangu district) and in *Coffea arabica*. According to literature, *C. arabica* is rarely attacked by this *Xyleborus*. Only a few instances of attack could be found in the plantation. It is possible the weakening of the trees under the droughty conditions prevailing made establishment easy for the pest. Immediate pruning out of the wilting attacked premaries can hold the pest in check. The control of thrips and hemileia, to prevent leaf cast at the end of the primary growth and the consequent branch die-back, may be advised as a sound prophylactic.

18. Where plantations have given thorough attention to the method of control of the white stem borer *Anthores leuconotus*, Pasc., set out in the Report of 1932 (p. 70) the numbers of borer grubs have in comparison with pre-existing conditions been very considerably reduced, indeed in places to the vanishing point. It would appear that the rubbing of the stem with hessian cloth at and eight to nine inches above ground level to expose the early working channels of the grubs effects the removal of the superficial rough dry bark and obtains a smooth surface of stem on which the female beetles find

difficulty in obtaining a foothold for thrusting the ovipositor down beneath the cambium for egg-laying.

19. The drought conditions have, again, favoured the activities of the dusty ground beetle *Gonocephalum simplex*, F., which effects deep vertical-sided pitting of the bark of stems of coffee up to two and a half to three years near ground level in search of juicy tissue. The pitting may agglomerate and may ultimately completely girdle the stem and kill the tree. These wounds are frequented by *Zophosis agaboides*, Gerst. and *Rhytinota gracilis*, Gerst. (Tenebrionidæ) and *Cydnus lepidus*, St. (Cydnidæ), the latter in great numbers. The clean weeding of coffee on land frequented by *Gonocephalum* is to be deprecated. The presence of succulent weeds goes far to obviate serious *Gonocephalum* damage. Where permanent cover crops produce a heavy mulch of vegetable mould a large *Gonocephalum* population will almost certainly result. This mould should be periodically partially turned in and, as these permanent cover crops tend to a hard wiry growth as distinct from a sappy growth, some type of succulent weed or crop growth (e.g. cowpeas, lupins, etc.) should be sparsely established to provide *Gonocephalum* with juicy thirst-satisfying food. If this is lacking coffee will be resorted to to provide it. In October, various Tenebrionid grubs were responsible for ring-barking of young coffee. There was in the affected (and droughted) plantations a complete dearth of alternative succulent food.

20. The coffee crop of 1934 between the contiguous lower and early areas and the higher and later areas of the mountains extended over six months, and ripening was noticeably slow. The conditions tended to favour a high incidence of fruit flies (Trypetidæ) in the coffee plantations, and in the later cherry pulpings a thick scum of Trypetid maggots could be seen on the water of factory tanks. While maggots develop entirely within the cherry pulp of coffee it is problematical if their presence there affects the merchantable bean as to size or quality; damage occurs, however, when the maggots drill their respiratory pores through the cherry skin towards the basal third or stem end of the cherry. Decomposition organisms gain entry to the cherry pulp through these pores and the attachment of cherry to stem is thus weakened. With heavy thunder showers of rain as are liable to occur during the period late November to early December, and which are generally accompanied by strong driving winds, much fully developed coffee is knocked to the ground. Sanitation in the factory is desirable immediately maggots in numbers appear (indicated in the field by premature colouring up of cherry), and maggots should be strained out of or skimmed off the tanks and immediately deeply buried with quicklime. A method of treatment of cherry pulp used in compost making and which also contains maggots may require to be devised. However, the situation may normally be held in check with weekly applications of weak arsenite/sugar bait as for antestia, using 20 instead of 60 grammes of arsenite of soda per four gallons of water. *Ceratitis capitata*, Wied.—the Mediterranean fruit fly—was the predominant species. The parasite and trypetid material reared will be further studied.

21. Root knot, *Heterodera marioni* (Cornu, 1879) Goodey, 1932, is generally distributed in the plantations of Kilimanjaro and Usambara, but no evidence is forthcoming that *Anguillulina similis* (Cobb, 1893) Goodey, 1932—*vide* in lit. *Tylenchus coffeæ*, Zimm., 1898—or *A. pratensis* (de Man, 1881) Goffart, 1929, which have caused damage to coffee in the Netherlands East Indies, are as yet present in Tanganyika. There is evidence to suggest that *Heterodera* is represented in the territory by several specialised or

biological races, e.g. coffee on the silt soils of west Arusha has not been observed to be attacked although vegetable crops are, while, in Usambara, coffee in nurseries established in clearings of primeval forest shows heavy infestation of the roots but vegetable crops, including potatoes, are free from attack. In Kilimanjaro coffee and vegetable crops are alike subject to attack. In Kilimanjaro potatoes on new land are clean, but where irrigation is practised the irrigated sections of fields show "pimple." This may suggest that nematode is irrigation-borne or that the presence of water activates latent nematode stages in the soil. Established coffee in Kilimanjaro of varying ages up to thirty years may show very heavy root infestation yet, as to vegetative vigour and bearing capacity, is most satisfactory. Where coffee is bowled over by nematode presence it may be reasonably assumed that conditions are otherwise highly unsuitable for coffee culture, and the fields should be abandoned.

22. With regard to the subject of a coffee stock resistant to nematode, the original reference to this work is the "Bulletin Agricole du Congo Belge," Vol. XII, Pt. 4, p. 709, in an article by M. Ghesquière, who recently stated :—

"*Coffea myrtifolia*, Roxb., d'après M. Lebrun (Jardin Botanique de Bruxelles), serait un *nomen nudum* désignant un caféier de l'île Maurice. Depuis la publication de ce nom par Roxburgh, il n'a jamais été parlé de cette espèce qui devrait être considérée comme synonyme de *C. arabica*. Ce dernier a été, de fait, importé autrefois à l'île Maurice. Il y aurait tout au plus lieu de considérer, je crois, *C. myrtifolia* comme une forme à petites feuilles de *C. arabica*.

"D'après les catalogues, des graines de *C. myrtifolia* étaient vendues par Berlin et c'est pour cette raison que le Jardin Colonial de Laeken (Bruxelles), le Jardin Botanique d'Eala et la plantation de Lula (Congo Belge) possédaient des caféiers étiquetés *C. myrtifolia*.

"En ce qui concerne les plants résistant à la maladie vermiculaire : les parcelles que j'ai observées au Congo étaient plantées de *C. myrtifolia* ou désignés comme tels qui provenaient surtout d'hybrides *C. robusta* et *C. arabica* (*myrtifolia*). Les Robusta et Arabica provenant du dédoublement de ces hybrides ne résistaient pas à la maladie, tandis que les pieds hybrides subsistants paraissaient tous en bonne santé."

It is proposed to follow this work up at the Kilimanjaro Coffee Experimental Station.

Coffee Shade Insects.

23. *Sesbania* sp. is used as a temporary shade in young coffee but after reaching the age of six months to a year the main stems are seriously attacked by the caterpillars of *Argyroploce rhynchias*, Meyr. and *Laspeyresia phaulomorpha*, Meyr. (Eucosmidæ) which mine in the succulent superficial tissues at the junction of branches and main stem and by girdling kill out the shade. In anticipation of this attack, which is regular, relays of *Sesbania* should be planted and the older plants when approaching the age susceptible of attack should be cut down as a green soiling crop. While the *mringa-ringa*—*Cordia holstii*—which is largely used as a coffee shade is comparatively free from pests its congener, *C. ovalis*, shows the following interesting enemies : the stem borer *Calothyrza bottegi*, Gestro (Lamiidæ) and the bark feeders *Idiopogon uranopla*, sp. n. Meyr. and *Trilochana phaædrostoma*, sp. n. Meyr. (Aegeriidæ) *vide* "Exotic Microlepidoptera," Vol. IV, Pt. 15, of June, 1934. *Ceroplastes* sp. (probably new) was recorded on *C. holstii*. Other pests

attacking shade trees of coffee included: *Ceroplastes zonatus*, Newst. and *Hemiberlesia lataniæ*, Sign., on *Pithecolobium saman*. *Lecanium* (?) *somereni*, Newst., *Pinnaspis chionaspiformis*, Newst. and *Bunæa caffaria*, Stoll (Saturniidæ) on *Erythryna* sp.

In the course of examination of wild hosts of coffee pests, the following stem borers were also reared:—

Opepharus spectabilis, Perr. (Lamiidæ) ex *Croton magalocarpus*, Hutch.;

Lixus bisulcatus, Fst. (Curculionidæ) ex *Vernonia* sp; and

Azygophleps sp. (Cossidæ) ex *Cassia siamea*.

Coffee Spraying.

24. Our coffee planters of the Northern Province have in the past few years graduated from the knapsack and wheel-barrow sprayer to the more effective manual headland sprayers, and several power outfits have now been installed. In this work the department has had for guidance of planters and demonstration purposes a useful selection of sprayer models, including various improved type bucket pumps for nursery and individual tree work—"Eclipse" senior and junior models for the requirement of the smaller plantations and manual headland (Drake and Fletcher) and "Triumph" engine power models (Drake and Fletcher) to suit the possessors of large acreages of coffee. Recently, an "Edwinson" sprayer (to specification of the Entomologist), engined with a light, air-cooled Petter (Swinson Engineering Co.) has been added to this equipment, which in all respects is absolutely up to date.

25. Spraying has shown a steady advance in popular favour. For this we are indebted to the presence in the area of several excellent demonstration plantations, which to be seen could leave no doubt in the observer's mind as to the great benefits to be derived from intelligent spraying. Heretofore, coffee was liable to undergo (and in the majority of plantations did undergo) three defoliations per year—from thrips in the period December-March, from hemileia July-August, and from leaf-miner October-November—leading to a general weakening of the plantations and causing considerable (in cases total) loss of crops. Adhesion to the department spray programme has aided in greater regularity of annual bearing and improved yields, moreover, with effective antestia and thrips control a soundness or undamaged condition of cherry is obtained which ensures the cherry remaining safely on the trees and coming to that full development which is essential to well-formed plump bean of full bodied cup quality. It is now felt that if the benefits of our spray work are to continue to be fully reaped then the plantations must be assisted to continue to bear the heavier crops accruing from this pest and disease control by a well devised scheme of manuring, organic and inorganic, for the drain on trees and soil is now become greater: the time has come when there must be a plus as well as a minus factor in coffee plantation management. The minus factor has too long and alone pertained.

26. The years 1933 and 1934 have not altogether favoured the obtaining of best results from spray work. In January, 1933, there was a very heavy and quite unusual rainfall which assisted a very heavy and unseasonal development of hemileia prior to the application of the programme pre-monsoon bordeaux-nicotine-soap spray. This was followed by the failure of the monsoon rains of April-May. Drought conditions continued for the remainder of 1933, so that when time arrived for the 1934 spraying most of the plantations were in a state of partial to almost complete defoliation and could neither derive

the tonic effect of the copper spray nor was the new foliage resulting from the monsoon rains protected. On the department's advice planters are substituting the December lime-sulphur first thrips spray with a bordeaux-nicotine-soap, so that what weather may come between the short blossom rains and the heavy season rains they have afforded the foliage an initial prophylactic copper spray.

27. During the past year the combination of cold oil emulsion (Yothers' formula) with the bordeaux-nicotine has been successfully applied where green scale was present in the plantations. This type of combination is being experimented with against leaf-miner, where the nicotine acts as a contact ovicide, kills the newly-hatched larvæ and disposes of the external forms pupating or proceeding to pupate, and also the adult moths. Various oil sprays (particularly the white oils), assisted by spreaders of the "sulphonated lorol" type, will be further experimented with on the lines of Kearns and Walton of Long Ashton against apple saw-fly. We are greatly indebted to Messrs. Kearns and Walton for much advice and courteous demonstrations when at Long Ashton.

28. Prices of spray chemicals have gone down most appreciably during the past few years, and to-day's prices in Moshi fluctuate around :—

Copper Sulphate, per cwt.	21/50 to 23/50
Quicklime, per ton	205/- ,, 225/-
Arsenite of Soda 80 per cent., per 56lb. ...	17/- ,, 18/-
Nicotine Sulphate, per lb.	3/- ,, 4/-
Sulphur, per ton	225/- ,, 280/-

There is need for planters to exact guarantees as to quality of spray chemicals on offer, particularly in nicotine, soap and arsenite of soda. Dissatisfaction with out bordeaux-nicotine-soap (1 per cent. bordeaux with 5lb. potash whale oil soap and $\frac{1}{2}$ pint nicotine sulphate per 100 gallons spray) has been expressed in certain quarters but failure against thrips has been attributable to inferior nicotine. The subject of legislation for standards of agricultural chemicals generally was discussed at the Amani Conference in the early part of this year (1934).

Sisal Insects.

29. The advent of sisal weevil, *Scyphophorus acupunctatus*, Gyll., to German East Africa—an observation made just prior to outbreak of war—was chronicled in an article by Morstatt in "Der. Tropenpflanzer," Vol. XXIV, 1921. It is highly probable, however, that the pest had found entry into the German colony many years previously in planting material from the new world tropics—the home of the insect. The first of this sisal material had arrived in 1893. Leefmans, of the Netherlands East Indies, published an illustrated and descriptive pamphlet ("De Agavesnuitkever") in 1920 recording the finding of the pest in East Java in 1916. Apart from these publications no extended treatise on the pest has since been made, and notes in economic literature are confined more to its mere geographical occurrence.

30. The Entomologist, on his initial voyage to Tanganyika, discovered specimens of Scyphophorus on the deck of the "Grantully Castle" when that vessel was passing through the Suez Canal in August, 1921, and upon arrival at Tanga in September and later in the year and in early 1922 he made a survey of the sisal weevil situation. To one with no previous experience of such weevil pests the numbers of the pest present in the adult and grub state in the derelict ex-enemy sisal properties awaiting disposal might have proved

highly alarming. It became early apparent to the Entomologist, however, that the problem presented by the sisal Scyphophorus resembled very much indeed certain problems which had come under his attention in the West Indies, viz. the striped coconut weevil *Metamasius serriceus*, Ol., the pine-apple weevil *Metamasius ritchiei*, Marshl. and the banana root borer *Cosmopolites sordidus*, Germ. The former, it may be remarked, breeds in very large numbers in diseased crowns of coconut (following "bud-rot") and in decaying banana stems from which the bunch has been cut. The pine Metamasius finds the decaying already fruited bases of pineapple suckers, diseased fruit, etc., highly suitable for its multiplication and so on. Senescent plant material is favoured by such insects as a medium in which to propagate, and as a general rule strict attention to plantation sanitation for the periodic removal of such material is the best insurance against such propagation. A plant condition in a way akin to the above may again result from attack of root or bud disease, poor soil conditions, unfavourable weather, or bad field husbandry as is unfavourable *per se* or as is inducive of disease, droughting, etc., of the crop. Such conditions are in the writer's experience more easily induced and serious in the monocotyledonous plants.

31. It is considered that the wave of weevil of 1934 was induced by the excessively droughty conditions of 1933-34 coupled in plantations with close cutting, leading to the premature exposure or unfurling of immature bud leaf which tended to wilt under the prevailing conditions and to leave a weak or "low tone" bud, attractive of weevil and liable to weevil bud attack. (Compare this condition with the attraction of adult weevils in great numbers to the small, yellowish rosette of leaves at the base of the sisal pole.)

32. The distribution of sisal weevil in the territory remains the same, namely, a triangle in the Tanga Province : Kenya border to Sakura on the coast and coming westward some 114 kilometres on the northern railway system.

33. The following general observations may presently be usefully made :—

(1) This attraction of diseased and senescent plant material for weevil pests has been remedially applied in the field as a trap for such weevils in the West Indies, as advised as early as 1924.

(2) The method of clearing up of old sisal fields prior to setting out of the new plantings would repay more thorough attention. The current method is to windrow and fire the windrowed materials, much of which is never subjected to sufficient killing heat, sufficient, however, to drive off living flying insect material to new fields. Where weevil is observed to be numerous the piling of material and application to it of a flame-gun of the inexpensive Egyptian type would prove both economical and effective.

(3) The maintenance of a single row planting system and the trimming out of secondary sucker growth permits of ready inspection of the fields for such a pest as weevil and the ready disposal of weevil infested material.

(4) The careful selection of sturdy planting material from the field (suckers) and from nurseries (bulbils) still merits close attention both as to freedom from weevil and sisal type.

(5) The importance of maintaining sisal plantings in strong vigorous general health cannot be too strongly emphasized.

(6) There is a satisfactory predatorial fauna present in sisal stumps infested by Scyphophorus, including the Histerid beetles *Hololepta scissoma*, Mars., *Hister geminus*, Er., and *Placodes ebeninus*, Lew. (*vide* Annual Report., 1922, p. 19). The Director of the Imperial Institute of Entomology

states, "It (Scyphophorus) does not appear to be of sufficient importance in Central America to have induced anyone to study it properly there, so that at present we know nothing about the natural control factors in that country."

34. A point worthy of investigation and which may throw intresting light on the sisal weevil problem generally is the observed greater attraction which *Agave amaniensis* has for weevil. In an experimental mixed sisal block examined north of Tanga *Agave amaniensis* was almost without exception attacked, Furcroya came a close second; attacked sisalana was rare. In the hybrid sisal, plants showing amaniensis characters were regularly attacked. It cannot yet be said whether the attraction or suitability for weevil establishment is chemical or anatomical.

35. In his 1922 report the Entomologist stated, "I do not predict the Scyphophorus installing itself as a major pest of the industry." Again *vide* Dar es Salaam *Times* of 15th November, 1924, he stated, "It is unlikely that the sisal weevil will play an important part in the future of the industry in the territory," and in the report of 1932, "The pest in its relation to sisal industry may be ranked as of minor importance when normal plantation work and a fair market pertain." The Entomologist (1935) can see no adequate reason for revision of his opinions, nor does he share any expressed view of apprehension for the future safety of our major industry.

Miscellaneous Pests.

36. *Orgyia vetusta*, Hampsn. (Lymantridæ) attacked geranium foliage badly and would prove an economic problem in the event of development of an essential oil business. *Mesochorus nigellus*, Wilk. (Ichneumonidæ) was bred from the caterpillars.

37. Kapok in the Usambara foothills has been severely attacked by the scale, *Phenacoccus iceryoides*, Green. The coccinellids *Cryptolæmus montrousieri*, Muls, and *Rodolia cardinalis*, Muls., from South Africa and also various local species of Chilocorus were introduced into the plantations by the muslin sleeve method along the infested kapok branches, but the dry weather has been decidedly against such experimentation.

38. Cotton from mid-May to mid-June suffered its annual generation of the American boll-worm, *Heliothis obsoleta*, F. Fields, in vigour readily repaired the damage and the net resulting loss to crop was nil.

39. There was an appreciable loss in newly planted out tobacco from the greasy cut-worm, *Prodenia litura*, F. There is an annual and remarkable northern migration of Prodenia early in May over the Northern Province with the onset of the season rains, and the moths come to veranda lights in very great numbers. It is the most common of the coffee cut-worms. Maintaining land clear of vegetation for some time prior to the planting date of crops is a counsel of perfection unattainable at that season of the year, and the initial clean weeding of field crops like coffee is inadvisable. A middle swathe of weed growth as an alternative food generally proves to be an effective crop protection against cut-worm.

40. There has been a very considerable increase in maize production in these (Northern and Tanga) provinces, and fields planted at the optimum planting season have suffered but little from the common maize worm of these parts, *Busseola fusca*, Fuller. Late or out-of-season maize showed high incidence of *Busseola* and *Peregrinus* "streak." Small rains maize (chance or irrigation crop) is invaded immediately upon germination by *Peregrinus maidis*, Asham., in great numbers from the main crop fields. If the present admirable freedom

of our maize fields from major pests is to be maintained, however, greater attention must be paid by planters to satisfactory disposal of crop residues. Present maize prices permit of a cleaner and saner agriculture.

41. *Sthenias cylindrator*, F. (Lamiidæ) has effected girdling of young tung oil plants (*Aleurites* spp.) of a half to three quarter inch diameter, arresting single stem development and producing a low-branched type of tree.

42. *Cerataphis lataniæ*, Boisa, was seriously attacking coconuts at Moshi.

43. *Mimastroides usambarica*, Wse. (Galerucidæ) severely defoliated peach in Usambara.

44. *Physothrips* sp. caused sterility of bean blossom (*Phaseolus lunatus*) and doubtless passed over to a crop food supply from the wild leguminous flora. *Entypotrachelus meyeri*, Klbe., was recorded as a leaf pest of the green manure crop *Crotolaria* spp.

45. The grubs of *Sphenoptera sublevis*, Kerr. (Buprestidæ) feed in the tap roots of *Afzelia quanzensis* (native name *mkoro*) and come just above ground level in the eaten out stem for pupation. The work of forest regeneration is being greatly retarded by this pest.

Archibald H. Ritchie,
Entomologist.

Annexure V.

REPORT OF THE ASSISTANT ENTOMOLOGIST, 1934.

1. The Assistant Entomologist has been on duty throughout the year. He was Acting Entomologist until 15th March, when the Entomologist returned from leave.

2. During the year 114 nights were spent on tour from Morogoro. Visits were paid to the Bukoba, Mwanza, Maswa and Shinyanga districts of the Lake Province, Kigoma in the Western Province, Bagamoyo and Dar es Salaam in the Eastern Province and to the Tanga Province. The Conference on Co-ordination of Agricultural Research at Amani was attended in February.

The African staff have toured the Western and Lake provinces on beeswax work, and one native assistant was stationed at Iringa during April for work on tobacco pests.

3. Extensions to the museum have been made during the year. The number of visitors has increased greatly. Demonstrations have again been given to African dressers, Medical Department, and scholars from the local central schools. An exhibit was staged at the Shinyanga Agricultural Show in July. Of the specimens added to the collection during the year, 130 species of insects have been identified by the Imperial Institute of Entomology, of which nine are new to science and twenty-six were not previously represented in the British Museum. Thirteen species of rodents have been identified by the British Museum together with eighteen species of parasitic worms (four of which are new) from this group.

4. Two entomological circulars have been issued during the year: No. 2 "Beehives" (in Kiswahili), and No. 3 "Sisal Weevil." Entomological Leaflet No. 12, "Rats and Mice," was re-issued in a revised and enlarged form.

Coconut Pests.

5. The nut-moth of coconuts, to which reference was made in the report for 1933, has now been identified as *Decadarchis minuscula*, Wals. This insect is widely distributed throughout the tropics. Though stated to feed in dry vegetable refuse there is no doubt as to its ability to feed on living coconut tissues in this territory.

6. The weevil *Diocalandra frumenti*, F., was received from Mafia, where it was found boring into the husk of large, green nuts. Larvæ were also present in the channels thus formed. This weevil is suspected of puncturing very young nuts and, by thus allowing the entrance of disease organisms, to be one cause of young nut fall.

7. The waxy scale, *Ceroplastes stellifer*, Ldgr., was found on coconut foliage on the coast.

8. A bug *Diostrombus abdominalis*, Dist. (family Derbidæ), was observed in large numbers on the foliage of young coconuts at Bagamoyo. It cannot be said with certainty if the yellowing of the foliage of infested plants was due to this bug or to the apparently unfavourable conditions under which the plants were growing.

Coffee Pests.

9. An Orneonid moth has been reared from larvæ boring in cherries of the wild *Coffea mufindiensis*. It has not yet been observed on cultivated coffee in the same area.

10. A beetle, *Sophronica* sp., was found in numbers feeding on dried coffee cherry in Bukoba. Injury to the bean resulted from the beetle gnawing the dried pulp. This injury is avoided if cherry is not allowed to remain on the tree too long, or if dry cherry is not stored before hulling.

11. There has been an increase of bean borer, *Stephanoderes hampei*, Ferr., on Robusta coffee in Bukoba during the year. During the month of May it was found that bean borer damage varied considerably from place to place, figures for bored cherries varying from five to fifty-seven per cent. The northern or purely Robusta areas showed most attack. Three species of parasitic hymenoptera were reared from Stephanoderes. These have been sent for identification; meanwhile two are provisionally identified as *Prorops nasuta* and *Heterospilus coffeicola*, known to occur in Uganda.

12. *Isaniris centropus*, Mshll., a weevil from Rungwe District, is to be added to the list of insects feeding on the foliage of coffee. It has not appeared in great numbers.

Cotton Pests.

13. The situation with regard to bollworm and other chewing pests of cotton (with the exception, of course, of the red locust) was exceptionally good in all parts of the territory. For example, in Morogoro the average number of pink bollworms present in 100 locules during September was one as compared with five last year, twenty-five in 1932 and twenty-two in 1931. Spiny bollworm (*Earias* spp.) was not present in numbers. It was found in the Lake Province that Earias larvæ were completing their development on the common weeds *Abutilon angulatum* and *A. mauritianum* when cotton was about to flower, and that the moths as they emerged flew to the cotton plants to oviposit. *Apion xanthostylum*, Wagn., the weevil stem-borer, has become a rarity in Morogoro, and was only found this year on Moco cotton plants which were being grown as a perennial on the experiment station. Many branches of the Moco cotton were broken off in high winds as a result of Apion injury, and the resultant wounds permitted the entry of termites. The cotyledon weevil from Kilosa, referred to in previous reports, has now been described as *Goniorrhinus terrenus*, Mshll. The results of boll examinations in the vicinity of Morogoro during the season are given below :—

Month	No. Bolls examined	Sound %	Locules Bollworm damage %	Stained %	Platyedra per 100 Cocules
July ...	850	83·2	0·7	16·1	—
August ...	2,700	34·6	0·7	64·7	1
September ...	3,000	15·2	3·4	81·4	1
October ...	600	6·8	12·1	81·1	3
November ...	—	—	—	—	—
December ...	850	65·6	2·4	32·0	1

It is suggested that the reduction in numbers of bollworms in the coastal belt is due to the abnormally low rainfall from August, 1933, to March, 1934, assisting the uprooting and burning measures to produce an exceptionally efficient dead season.

14. As indicated by the figures above, the position with regard to staining was not good. The apparent staining as observed in the field as the bolls

opened was not quite so high, since many of the bolls attacked failed to open at all. This applied to the whole of the coastal belt, and to Tabora, but was not so pronounced in the Victoria Lake basin crop. The prolongation of the rains in the coastal area produced conditions of climate and plant growth conducive to attack by aphis and jassids. Green bugs, *Nezara* spp., and Callidea bug, *Callidea bohemani*, St., were unusually numerous. Stainers, *Dysdercus* spp., appeared later but were at no time conspicuous and not at all in numbers proportionate to the amount of staining observed. It was demonstrated in cages at the laboratory that both *Callidea bohemani*, St., and *Nezara* spp., are capable of producing stained locules and preventing completely the opening of bolls. It will be seen from the boll examination figures—which incidentally were discontinued during November owing to scarcity of large, green bolls—that such crop as was picked in December was much cleaner than in previous months.

Pests of Native Crops.

15. Sesame (*Sesamum indicum*) was severely injured in parts of the Morogoro District by the weevil *Phacemastrix picta*, Hesse. The larvæ of this insect bore in the stems and cause the plants to wilt and die as the seed pods are forming. A new species of weevil *Sphrigodes crinitus*, Mshll., has been described from specimens feeding on foliage at Morogoro. *Sphrigodes globulus*, Mshll., another newly-described species, defoliated sesame in the Southern Province. The coffee capsid, *Lycidocoris mimeticus*, R. & P., hitherto known only in the territory as a pest of coffee in Bukoba, was collected in numbers on sesame in the Kahama District.

16. Groundnuts in the Southern Province were defoliated by two new weevils *Systates alticollis*, Mshll., and *Sphrigodes globulus*, Mshll. The mealy bug *Pseudococcus brevipes*, Ckll., was found attacking developing pods below ground level at Mwanza. The bug was not extensive, but since it causes discoloration and decay of the outer layers of the pod it might prove of importance where groundnuts are grown for the confectionery trade.

17. The practice of growing a second crop of early maturing sorghum (variety Feterita) in the Lake Province has brought into prominence the sorghum stem-maggot *Atherigona indica*, Mall. (family Anthomyiidæ). This is a new pest record for Africa, the fly being known previously from Southern India. Late sown Feterita plants showed a high proportion of dead hearts due to the feeding of pale yellow maggots, about 6mm. in length when fully grown. Rotting of the tissues followed, and secondary infestation by the smaller white maggots of a Chloropid fly was general. Infested plants tiller excessively, with progressive infestation of the young tillers. Broom-corn tillers were also found to be infested, but this was of little importance as the crop was nearly ripe. The application of derris preparations has proved to be capable of giving an almost complete control of stem-maggot at an economic cost.

18. Grain crops in the Lake Province were subject to much injury from stalk borer, *Busseola fusca*, Hmpsn. (Noctuidæ). Early in the season young plants were attacked, the growing points of the main shoots being eaten. Later broods bored into the stems and flowering heads. Maize was attacked in preference to sorghum, and bulrush millet (*Pennisetum spicatum*) least of all. Bored stems blow over in high winds with consequent loss of crop. When a sorghum stem is attacked the head matures without growing clear of the leaves. The unextruded portion fails to develop with the result that

moulds and grain weevils are attracted in quantity, and are thus introduced into the store.

19. Butter beans (*Phaseolus lunatus*) in the Rungwe District was attacked by a very small leaf-eating weevil which has recently been described as *Systates minimus*, Mshll.

Miscellaneous Insect Pests

20. The shot-hole borer *Apate indistincta* has appeared as a pest of almond trees in Iringa. Previously it had only been known from wild trees in the same locality. A large undetermined Bostrychid borer caused much damage to flamboyant trees. Young eucalyptus trees were seriously defoliated by the beetle *Megalognatha lamaticornis*, Lab. (Galerucidæ). Potatoes were defoliated by the meloid beetle *Epicauta nyassensis*, Haag., which is common on wild Solanaceæ. On one coffee estate the establishment of *Indigofera endacaphylla* as a cover crop was hindered by the coccinellid beetle *Phædonia areata*, F., which attacked the foliage. Experimental plots of *Bœhmeria utilis*—the ramie fibre plant at Morogoro—were attacked by the spiny caterpillars of *Acrea joduta*, F., and *A. pharsalus*, Ward. Spraying with lead arsenate gave a satisfactory control. Another injurious *Acrea* newly recorded was *A. acerata*, Hew., the larvæ of which defoliate sweet potatoes in our north-western districts. Peppermint was severely injured at Morogoro by a tingitid bug *Monanthia* sp. (near *globulifera*, Wlk.), and a root-feeding scale insect. The coccid was controlled by soil fumigation with paradichlorobenzene at the rate of four ounces per square yard, and by planting up new areas with roots which had been fumigated with carbon bisulphide. The tingitid was controlled by pyrethrum sprays but reinfestation was rapid although no other host plants have yet been found. These two pests will have to be watched where growing of peppermint is undertaken on a commercial scale.

Locusts.

21. The tropical Migratory Locust, *Locusta migratoria migratorioides*, R. & F., has not been greatly in evidence during the year. There was some egg laying during January in Biharamulo, at the south-west corner of Lake Victoria. During the same month laying was reported in Ufipa, where hoppers were again present in March. No further reports were received until September, but it is believed that migratory locusts were present either in small swarms or in mixed swarms with the red locust in a number of areas to the west of 33° E. Longitude. Flying swarms were reported from Ufipa in September. During November swarms were reported from all parts of the Tabora District and mixed swarms moved south-east from the Rukwa towards Mbozi and Tukuyu. Egg laying took place on a limited scale south and west of Tabora and in Kasulu during November, and hoppers emerged during December.

22. The territory was seriously involved in the large scale northerly breeding migration of the Red locust, *Nomadacris septemfasciata*, Serv., which began in December, 1933, and continued through January. Invading swarms crossed our southern border from Nyasaland and Portuguese East Africa and, joined by swarms of our own, swept northwards with diminishing vigour until a small proportion passed into Kenya. At the end of the first week in January egg laying had taken place as far north as the Central Railway and soon afterwards in the Northern Province. In many localities there were two and three distinct layings. The territory was generally infested. The adults

of this generation had disappeared in most parts by the end of January except in the vicinity of Kilimanjaro and the Usambara Mountains, where they persisted until March. Considerable destruction of egg masses was done by the fly *Stomatorrhina lunata*, F., particularly in the western and south-western areas. Other unidentified dipterous larvæ and a number of predacious Mylabrid larvæ were found attacking egg pods in many areas. *Scelio howardi*, Craw. (Hymenoptera, Scelionidæ), was reared in numbers from parasitized eggs received from Kahama.

23. Red locust hoppers began to emerge from twenty-two days after oviposition. The hopper stage occupied about ten weeks under normal conditions but considerable extension of this period was noted particularly among the later hatchings. Many hoppers were killed by the fungus *Empusa grylli* in areas where the rains were unusually prolonged, particularly in the foothills of the east coastal ranges. Hopper bands showing retarded development were particularly susceptible to fungus attack. It is to be noted that late hoppers reared in cages at the Laboratory, Morogoro, while retarded in development remained quite free from Empusa attack, while hopper bands within a mile were killed off by the fungus.

24. The first flyers were reported from the Southern Province and from the south of Morogoro District at the end of March. Hoppers persisted in the Kilimanjaro area until July. The young swarms showed a general tendency to move northwards until September. Foothills, mountains and well-wooded country were attractive, and swarms disappeared from most of the open settled areas. During October there was a great increase in the number of ambulant swarms reported, owing no doubt to an exodus from the dense bush and forests. Some swarms in the extreme south showed southerly movement, but generally no specific tendencies were to be noted, the swarms appearing to diffuse over the countryside rather than fly definitely. There was no pre-breeding migration on a large scale in December but egg laying in small, diffuse patches was reported from a number of localities during the month.

Apiculture.

25. The quantity of beeswax exported from the territory during the year was 8,140cwt., which is 40 per cent. less than in 1933. The value at the coast was £32,707, an average of Shs. 80·3 per hundredweight as compared with Shs. 77·6 last year. This decrease in production has been common to all the wax producing areas, though the proportionate decrease has been greatest in the Southern Province. There was little swarming to be observed towards the end of 1933 owing to the more or less general failure of the short rains, and the rains of 1934 were poor in the wax districts. Locusts destroyed the foliage and flowers of many nectar bearing trees in the bush.

26. A large proportion of the beeswax of Tanganyika is exported as "Dar es Salaam sorts," that is, as sacks of small pieces of wax of different colours, ranging from red to pale yellow with a more or less fixed minimum of yellow shades and free from obvious dirt. This wax is mainly the produce of the Western Province. Red wax from Dar es Salaam and all wax exported through other ports is classed as ordinary East African, and does not command quite so high a price. The paler yellow colours, which are the more valuable, has been found to be produced mainly in *Brachystegia-Berlinia* woodlands, particularly those of the plateau west of the Central Rift. Other vegetation communities will produce a pale wax, e.g. parts of the swamps of the Rufiji delta and the coconut groves and scrub of Mafia Island; but they are compar-

atively unimportant. Upland areas generally yield a darker wax the higher one goes. *Acacia* savannah and *Combretum*, etc., woodland produce the redder shades of wax.

27. Trials of bulking wax to produce a standard packing for export have shown that the melting together of mixed colours results in a shade which is distinctly inferior to red alone and is not favoured by many brokers. Rules, for consideration, are being formulated for the grading of Tanganyika beeswax, and to prevent the introduction of beeswax from other sources.

28. Forest policy and native bee-keeping has been the subject of discussions with the Conservator of Forests, and the following memorandum issued :—

"In *Brachystegia-Berlinia* woodland—which constitutes the greater part of the beeswax producing country—the encouragement of native bee-keeping is not contrary to forest policy, provided that—

(a) the native is encouraged to use *miombo* bark for hives;

(b) in localities remote from towns and railways, where Pterocarpus is used for log-hives, each tree cut should be fully utilized.

"In certain close forests much exposed to fire menace—e.g. North Kilimanjaro, Meru, Nou (Mbulu), Marang (Mbulu) and the Northern Highlands (Ngorongoro area)—bee-keeping is not to be encouraged and honey-hunting is to be actively discouraged.

"In highland areas where Brachystegia is unobtainable free issue of trees of non-timber value from forests shall be made to natives for making log-hives, provided that the hives are for use outside the forest."

Acknowledgments.

29. We have to record our appreciation of the assistance given during the year by members of the following institutions: the Imperial Institute of Entomology; Zoological Department, British Museum; and the East African Agricultural Research Station, Amani.

W. Victor Harris,
Assistant Entomologist.

Annexure VI.

REPORT OF THE MYCOLOGIST, 1934.

1. *Routine.*—I was on duty throughout the year, stationed until 23rd November at Morogoro; on that date I transferred to the Coffee Research and Experimental Station at Lyamungu near Moshi. Safaris were undertaken to the Usambaras in February and to Ruvu in March to study particular problems in tea and sisal. In May-June five weeks were spent in the Iringa Province primarily to investigate root disease in coffee but other problems also. I attended the Conference on Co-ordination of Agricultural Research and Plant Protection at Amani on 12th to 15th February.

2. *Publications.*—Two leaflets have been printed, No. 15 "Diseases of Tobacco," and No. 16 "A Report on a Survey of Plant Diseases in the Iringa Province." The former was printed also in *The Planter*, published by the Northern Province Press at Arusha.

3. *Diseases of Crops: Root Disease of Coffee, Tea, etc.* (*Armillaria* sp.).—This disease was investigated in the Usambaras and in the Iringa Province. As the trouble has been discussed in leaflets already circulated to planters and others it is only necessary here to refer to new features and to emphasize important facts concerning control. The number of rain-forest and savannah trees which become heavily infected in their roots after the trees have been felled seems to be limitless; an exception, requiring confirmation is camphor, *Ocotea usambarensis*. The susceptibility of living indigenous trees is more difficult to observe, but *Trema guineensis* is definitely very susceptible—sheets of mycelium have been observed under the bark to ten feet from ground level.

Two points of importance are as follows: Firstly, when forest or bush trees are cleared for woody crops without the removal of roots to a depth of at least two and a half or three feet, there is a likelihood of the disease appearing in the latter some time later and continuing as long as the old roots remain in the ground. The practicability of removing stumps and roots depends on their size and the degree of slope of the ground. When the disease occurs in scattered isolated crop trees on land covered originally by savannah, the diseased trees and infective material can be successfully and economically removed; at the other extreme is the case of a heavily infected crop on land full of roots of heavy timber.

The second important point is that however susceptible a crop may be there is insignificant risk of infection unless the conditions favouring it are present, i.e. unless, primarily, infective material is left in the ground. The planter opening up new ground for perennial crops should realize that if it is covered with timber he must either undertake the expense of initial clearing of stumps and roots or run the risk of losing few or many of his trees in the course of time.

The number of living trees, shrubs and other plants found to be susceptible to Armillaria steadily increases. In Tanganyika thirty-one are known, the following twenty-three are now recorded: *Acacia dealbata*, *A. decurrens*, *Acacia* sp. (indig.), *Acrocarpus fraxinifolius*, *Albizzia moluccana*, *Cajanus cajan*, *Calodendron* sp., *Cedrela odorata*, *C. toona*, *Chlorophora excelsa*, *Citrus*

aurantifolia, *C. aurantium*, *Crotalaria* sp., *Cupressus lusitanica*, *Cyphomandra betacea*, *Erythrina lithosperma*, *Eucalyptus citriodora*, *E. globulus*, *Jacaranda* sp., *Rosa* sp., *Sesbania* sp., *Trema guincensis*, *Widdringtonia Whytei*. Of the total fifteen have not been recorded elsewhere. Armillaria has not been observed in the territory below an elevation of 3,000 feet, possibly because the important susceptible crops occur and have been examined at higher elevations. In addition to the areas mentioned above, the soil on parts of Kilimanjaro is heavily infected where forest has been felled in recent years.

A Disease of Coffee, Tea, etc.—In June of this year I encountered a disease of coffee and tea and other economic crops at Mufindi; material was later received from Dabaga, also in the Iringa Province. Both districts are characterized by high elevations of 6,000 feet and over and by very cold weather during the rainy season. Small erect fascicles of fungus hyphæ on the leaves and other organs are thought to be *synnemata* and the fungus to belong to the family Stilbaceæ. The synnemata are however sterile, and no other fruiting bodies or sclerotia have been seen in the field or in cultures of the fungus. A rather similar disease of coffee is known in Surinam, British Guiana and Trinidad, but in that case the presence of sclerotia, although sterile, enabled Stahel in Surinam to provide a name for the parasite (*Sclerotium coffeicolum*). Relationship between the two diseases cannot yet be determined. The present fungus multiplies and is destructive only during the cold, wet season in the areas where it is endemic. It is most abundant in parts where dampness is encouraged by enclosed conditions and, it seems, where crops are sheltered by the very susceptible *Grevillea robusta* and eucalyptus species.

The fungus was observed on fifteen economic species of plants and an indigenous tree, *Bersama* sp. On coffee the significance of the disease is that it causes considerable premature fall of leaves and cherries, while in tea it affects all but the youngest leaves.

The control measures suggested are to prevent excess humidity resulting from the presence of dense wind-breaks or proximity of forest. Unduly increasing exposure to the strong cold winds has, however, to be avoided. It is suggested that where shade trees occur in groups they be thinned out. Local experience indicates that lime-sulphur is ineffective as a fungicide for this parasite, whereas bordeaux mixture with alum as an adhesive decreased the amount of disease very considerably. A two-per cent. mixture was found effective but it may be possible to reduce the strength. The alum was used at the rate of six ounces to sixteen gallons. Collecting and burning fallen leaves should assist in control.

The disease is undoubtedly spread during the rains by means of the loosely-attached synnemata, but the method of survival from one wet season to the next has not been shown for this parasite. It probably depends on the existence of a stage of the fungus not yet found, such as sclerotia.

Yellowing of Coffee.—Observations have indicated several distinct causes of yellowing. These briefly enumerated are as follows : Armillaria root injury; various insects at the lower parts of the plant; injury to roots by cutting; cold winds; in one case clayey soils (nearer a percentage of 75 than 50 per cent. of clay); competition with cover crops during the dry season (e.g. at Mbozi) and with grass weeds which require to be cut back or removed in different cases; and apparently deficiencies of plant food materials in the soil.

Native Coffee at Tukuyu.—This subject was referred to in the report on my visit to that district, but it would be well to repeat here what I consider are the factors which contribute chiefly to the exceptional health of this coffee. Being in small plots they are generally chosen from the deeper, better soils—in the district pumice lies as a rule in strata to within a foot or less of the surface. Also the choice of level ground on which little or no surface wash has occurred is the rule. The heavy manuring of the bananas growing among the coffee benefits the latter. In this connection the report of the Soil Chemist in the Sixth Annual Report, pages 18 and 19, of the East African Agricultural Research Station, Amani, should be read.

Tobacco.—Mosaic disease has been definitely established as an important disease of tobacco in the territory, but it is restricted in its distribution. Wildfire (*Bacterium tabacum*) was found to occur in the Songea District, but strict control measures were at once established by the agricultural assistant in charge when the nature of the disease became known. I am indebted to Dr. Hopkins, Plant Pathologist in Southern Rhodesia, for the identification. Mycological Leaflet No. 15 was issued in August, describing the symptoms and control of the tobacco diseases in the territory.

Sisal.—A preliminary field test with small quantities of artificial manures indicate that the stem-rot disease is reduced by their use. An experiment on a larger more significant scale is planned for 1935. A number of fungi and bacteria have been isolated from the rotting stems; one fungus was found capable of causing a local rot on leaves when these were injured and kept in a moist atmosphere. This serves to confirm the field observation that an organism gains entrance through cuts when the sisal is cut during the rains.

Cereals: Sorghum.—The demand for sulphur for seed treatment against smuts is steadily increasing, particularly in the Tabora and Mwanza provinces and in the Kilosa District, and the process is expected soon to become a regular routine measure where the smuts are destructive.

Wheat.—Glume Blotch (*Septoria nodorum*) is rather destructive in the wheat areas of Dabaga. Further tests of wheats for their general suitability and for rust resistance, and meantime also as indicators of the rusts present, are being undertaken by the District Agricultural Officer, Iheme, Iringa, for the Senior Plant Breeder, Nairobi. Results of considerable value are expected.

Barley.—Covered smut was found at Mufindi; it is proposed to try the seed treatment with sulphur recommended by G. H. Jones in Egypt.

Rice.—*Helminthosporium Oryzæ* is recorded in the Kilosa District; it is probably more widespread. A few varieties of rice having a reputation for resistance to the disease Blast (*Piricularia Oryzæ*) now recorded in this territory, have been introduced from Madras for trial. I am indebted to Mr. Sundararaman, Government Mycologist, and the Paddy Specialist Madras, for the samples of seed. The trial is being undertaken by the Senior Agricultural Officer, Lindi.

Sugarcane.—The Plant Pathologist, Amani, has recorded Mosaic in a native field in the Usambaras; the plants were destroyed.

Cassava.—Vegetative propagation of cassava plants originally free from the leaf-curl disease has been continued now for three generations. While some of the isolations are still free it is thought that resistant strains will be more likely obtained through seedlings. It is established that secondary infection occurring late in the season has no effect on the weight of the crop of plants grown from cuttings from healthy plants.

Avocado Pear.—At Morogoro a plot of seedlings and young trees ten feet high suffered severely from a disease of unknown origin. Cancerous lesions occur sometimes along the whole length of the stem and of the branches. They start as small, water-soaked, raised blisters of grey-brown colour which burst and liberate a red gum. Twigs sometimes bend over at the lesions. No leaf-spotting was seen, but there is a very noticeable clustering of leaves. No fungi were seen; bacteria are suspected to be the cause. Trials for control are being made.

Citrus.—Ring Blotch is recorded from Usanga in the Iringa Province. The control effected in South Africa by the systematic use of green manures has been recommended for trial.

Vine.—Downy Mildew (*Plasmopara viticola*) is recorded from Ruvu.

Peach.—Leaf-curl (*Taphrina deformans*) is recorded from the Iringa Province. It has apparently little significance.

Poinciana regia.—This tree is recorded as an additional host for *Ustulina zonata* in the territory.

Pelargonium sp.—A vascular bacterial disease believed to be caused by *Bact. solanacearum* occurred suddenly and destructively in a garden at Morogoro. The plants were burned and the soil treated with formalin. There has been no recurrence.

I wish to take this opportunity to acknowledge the assistance received as in previous years from officers of the staff of the East African Agricultural Research Station, Amani.

Geo. B. Wallace,
Mycologist.

Annexure VII.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL ASSISTANT.

My duties during the year were divided between Head Office and the Morogoro Experiment Station, the work done at head office being the technical side embracing such matters as plant and seed introduction and distribution, economic botany and agricultural legislation. Duties on the experiment station are the maintenance of the orchards and nurseries and propagation of nursery stock and of introduced species of plants and seeds.

The nurseries have been fully maintained and there had been a considerable demand for plants. Revenue from the sale of plants is included in the report on the Morogoro Experiment Station.

The plants of *Coffea arabica* grafted and budded stocks of *C. excelsa* continue to thrive and are in exceptionally healthy and clean condition. Samples of the crop from these trees were sent to the Imperial Institute for technical report. Small blocks of *C. arabica*, grafted to different species of stocks, have been planted up, the stocks being *C. bukobensis*, *C. liberica*, *C. robusta* and *C. quillou*.

With the object of obtaining a variety or varieties of cassava immune or resistant to the ubiquitious leaf disease, a large number of seedlings have been grown and are still in the nursery stage. These will be planted out in due course and interplanted with susceptible varieties, any seedlings showing signs of the disease being at once eliminated.

In the first season of growing the introduced varieties of pigeon pea, *Cajanus indicus*, they showed earlier maturing qualities as against the local strains, but this quality has not shown itself in the second season. The introduced varieties are dwarfer and of more compact habit of growth than local strains.

Further supplies of cuttings of the Attar of Roses, *Rosa damascena*, were sent to the Iringa Province to planters interested in the production of essential oils, and the plants are stated to be doing well. *Rosa damascena* grows vigorously at Morogoro (1,700ft.) but it has not yet flowered.

Plants of peppermint propagated in the nurseries from the stock of plants originally received from Mitcham were badly attacked by lacewing flies and by a root scale. Disinfecting the soil in which the plants were growing and spraying the plants have not proved so effective as fumigation. The fumigated plants have been planted in the Morogoro River valley and are clean and thriving, but this cannot be said of the sprayed plants growing in disinfected soil.

A part of the Morogoro River valley has been set aside for the use of the department and is being developed as a botanical and tree reserve. In this area tree cutting by natives has been stopped.

Mention was made in the last Annual Report to the trial plantings of Criollo cocoa in the foothills of the Nguru and Uluguru mountains, and a further three large plots of this high-grade cocoa have been planted in the Morogoro River valley where direct supervision can be given. It is evident that in the early stages of growth the plants require a great amount of attention under prevailing conditions, and it is very unlikely that cocoa will be a success here as a native crop.

Other crops planted in the river valley are cardamoms, ginger, turmeric and peppermint.

A complaint received that sesame cake from the territory had been found poisonous to animals through seeds of *Sesamum indicum* being mixed with *S. radiatum* was investigated. Samples of *S. indicum* seeds from all sesame growing districts were obtained, and on examination in no instance were seeds of *S. radiatum* found. *S. radiatum* does not appear to be widely distributed or common in the territory, and there is no evidence that the seeds of this species are poisonous to stock. It seems probable that the poisoning may have been due to rancid sesame cake being used as stock feed.

A further trial consignment of citrus fruits from the Tanga Province, consisting of seventeen cases of seedling sweet oranges and three cases of Marsh grapefruit, were sent to England for report. Details of handling and packing have been mastered, but in the event of commercial export of citrus fruit from the territory to England it is obvious that a colouring plant and pre-cooling facilities are necessities. Owing to the steamer being overdue, by which this season's consignment was being shipped, the fruit had to stay in the customs shed at Tanga for some days, a circumstance not favourable to the arrival in England of packed fruit in good condition.

Samples of wild rubber from the Lindi Province were sent to the Trades Commissioner, London, who reported that there was a market for the product. The matter was taken up with commercial firms here and shipments have been arranged.

Acknowledgment and thanks are due to Kew, the Imperial Institute and to the Trades Commissioner, London, for their ready co-operation in many matters throughout the year.

T. H. Marshall,
Senior Agricultural Assistant.

Annexure VIII.

COFFEE RESEARCH AND EXPERIMENTAL STATION, LYAMUNGU.

Introduction.

1. It should be appreciated from the outset that this report, the first to be issued on the work of the station, is one outlining the year's activities in *preparation* for research and experimental work on coffee and not, with few exceptions, the usual annual outline of progress on investigational work. The institution is in every sense still in course of construction. No real team work on any coffee problems can be commenced until the complete staff is in residence and the necessary laboratories, offices, fittings and equipment ready. Such conditions are not likely to be realized before April, 1935.

2. Full details as to organization, finance, etc., were given in a paper read by the Chief Scientific Officer at the Planters Conference held in Nairobi in July. This paper has been published in full in the local press. A bulletin is also in course of preparation.

Staff.

3. Provision has been made for the following staff:—

*† Chief Scientific Officer, S. M. Gilbert, B.SC., N.D.A. (whole time).
Entomologist, A. H. Ritchie (part time).
Mycologist, G. B. Wallace, B.SC., PH.D. (part time).
*† Soil Chemist, H. B. Stent, M.SC., A.I.C., A.I.C.T.A. (whole time).
District Agricultural Officer, F. R. Sanders, B.A. (Hons.) C.D.A. (whole time).
*† Agricultural Assistant, Plant Propagator (Vacant).
* European Clerk, C. H. Taylor (seconded from headquarters).

4. Of the staff, the Entomologist, Mycologist, District Agricultural Officer and European Clerk were already members of the Department of Agriculture at the time of the inception of the station. Those marked with an asterisk are new appointments; these officers are paid from Colonial Development Fund.

5. The Chief Scientific Officer arrived in the territory on 23rd March. The Entomologist was on leave until 14th March and has not yet moved to the station. The Mycologist arrived on 24th November. The Agricultural Chemist worked throughout the year at the East African Agricultural Research Station at Amani on coffee soils of the territory. His report is attached as Annexure A. The District Agricultural Officer was available for part time work until 2nd August, from which date he was wholly employed. The European Clerk took up his duties on 6th September. From the beginning of the year until 31st October Mr. A. E. Weirich was employed as Agricultural Assistant, and on the latter date left to take up his appointment as substantive Agricultural Assistant at Lushoto. For this year the Entomologist and Mycologist submit reports as in former years, not as part of the station staff.

*Paid from Colonial Development Fund Grant.

†New appointments.

The nature of the work of the District Agricultural Officer, interwoven as it has been with that of the Chief Scientific Officer, renders a separate report from him for this period unnecessary.

6. It was realized immediately that a field recording staff would be necessary if the fullest use was to be made of the services of the senior officers. This staff was non-existent and is in course of creation; at the end of the year seven probationers, including two Africans, were employed.

7. Posts such as those of Mechanic and Laboratory Assistant remain unfilled until the appropriate buildings and equipment are ready.

Buildings.

8. The first residence was sufficiently forward to be occupied on 15th August. At the end of the year five houses were complete and the remaining two in an advanced stage of construction. Work has commenced on a double rest-house for the use of planters from a distance; similarly for two hostels for visiting workers. The officers and laboratories, which are in one block, are in an advanced stage of erection, and should be ready for occupation by the end of March, 1935; also housing for electric power plant, "Silverlite" gas plant and water supply pumps is ready and awaits the installation of equipment.

9. Numerous small but essential buildings, in particular those for use in connection with vegetative propagation of coffee, have not yet been commenced.

10. I am indebted to the Director, East African Agricultural Research Station, for providing laboratory facilities at Amani for our Soil Chemist throughout the year.

Board of Governors.

11. An advisory board was gazetted by Government on 25th August. The members are as follows:—

The Director of Agriculture (Chairman).
The Director, East African Agricultural Research Station, Amani.
Major R. G. Bellairs.
A. L. B. Bennett, Esquire.
W. G. Manson, Esquire.
P. J. H. Coldham, Esquire (from Kenya).
A. D. le Poer Trench, Esquire (from Kenya).
One official nominee from Uganda.

12. The first meeting was held at the station on 4th September, when the principal business was to examine the programme of work proposed by the Chief Scientific Officer and the staff of the station.

Programme of Work.

13. The programme, which complies with the principles of co-ordination in agricultural research adopted by the Conference of East African Territories held at Amani in February, has been passed by the board and submitted to Government with the request that it be published.

14. In pursuance of the programme a schedule of field experiments both for the station and for estates is being prepared. The designs adopted follow the methods evolved by Fisher and provide for a valid estimate of experimental error.

15. The policy as to the number of experiments to be laid down in the near future is, in view of the suspected degree of variability in yield of *Coffea arabica*, one of caution. The only individual tree yields available on my arrival were those obtained from an estate at Arusha for three years due to the

perseverance of Mr. D. Sturdy, District Agricultural Officer. The coefficient in that case was over 70 per cent. No experiments are being planted unless it is felt that there is a reasonable chance of obtaining trustworthy results. Study of the "build up" of the tree is fundamental and it would be foolish to plunge into numerous experiments on a perennial crop such as coffee until more is known of the material with which we have to work. During the period under review only two, namely, one experiment on soil erosion and one on methods of cultivation have been planted, the latter being on terraced land with hedges and cover crops (*Dolichos hosei*) on the banks.

16. It will be appreciated that it may not be possible in some cases to plant experiments, planned now, for some years. For example, supposing seedling stocks from selfed trees are to be grafted for use in a certain experiment; this involves selfing the flower say, in November, 1934, harvesting the seed formed in May, 1935, planting out in the nursery, grafting at possibly fifteen months old, say in August, 1936, and finally planting out in the field in 1937.

Development of the Station Lands.

17. The total area is 310 acres. At the end of the year the position in regard to opening up uncultivated land was approximately as follows:—

Forests (to be left untouched)	30 acres.
Cleared and holed for coppices, wind belts, etc. (mostly steep hill-sides)	3 ,,
Felled, cleared, stumped and cultivated (of this 24 acres are planted in Mauritius beans, *Stizolobium* sp.)	83 ,,
Nurseries	3 ,,
Experiments on coffee and collections of coffee species and varieties	4 ,,
Roads, buildings and gardens	20 ,,
Unopened up other than forests	167 ,,
Total area ...	310 acres.

18. On opening up the bush it has been found that the presence of several factors will render large areas of the land unsuitable for experiments for some years. Among such factors are the remains of squatter cultivation such as old huts and bomas, the presence of areas strewn with felspar rhomboid porphyry boulders and of numerous ravines and old trenches. Indeed it is difficult to obtain an area of as much as ten suitable acres in one compact block. The uniform treatment over a period of years under annual legumes which has been commenced will, it is hoped, gradually bring about suitable conditions for experimentation on some of the areas. About forty acres are sufficiently even for immediate planting.

Preparation for Future Experimental Work.

19. It has been pointed out above that adequate knowledge of the material with which we have to deal is fundamental to successful experimentation.

20. At the earliest date after staff was available, therefore, a general survey of conditions under which coffee is grown in the territory was begun.

21. At the beginning of harvest of the crop, with the kind co-operation of some fourteen planters and native peasant proprietors, areas were selected for detailed work, and it can now be reported that growth measurements and records of the cherry yields of some ten thousand individual trees of different

varieties and ages, and growing under various types of soil and climate, have been obtained for the first year.

22. The mass of data accumulated will be examined. This detailed survey work, with which all members of the staff are associated, has several objects in view.

23. Firstly, it is hoped in the course of a few seasons to be in a position to select mother trees strong in qualities desirable for commercial plantations as, for example, yield, boldness of bean, resistance to diseases and pests and suitability to certain soils and climatic conditions.

24. Concurrently with this work, study of commercial means of propagating coffee is proceeding; as, for instance, by means of cutting in solar propagators, layering, marcotting, etc. Budding and grafting in a preliminary way has also been commenced. Mr. Blaich of Sanya has been temporarily employed on this work pending the arrival of the agricultural assistant who has been appointed in Britain.

25. Work (by Mr. Doughty at Amani, Mr. Gillett at the Scott Laboratory, Nairobi, and Mr. Marshall of the departmental staff at Morogoro) has been of sound guidance in this direction.

26. Various planters, especially Major Bellairs of Kikafu Estate, Moshi, and in particular Rt. Rev. Bishop Byrne of the Catholic Mission at Kilema, has been most liberal in placing trees at our disposal for vegetative work.

27. Secondly, from records such as those mentioned above, it will be possible to learn the minimum number of trees per experimental plot that is essential to our obtaining results which can be accurately interpreted.

28. Planters will agree that the staff is much more likely to persuade a large number of estates to co-operate in carrying out experiments on their coffee if the area to be treated on the estate is reasonably small.

29. Most of the areas are so selected as to be available, when plot size is known, for future precise field trials.

30. A further preparatory step is the gradual collection at the station of many species, varieties and types of coffee by means of seed introduced with adequate safeguards from abroad. This material is necessary for work on hybridization, selection of stocks, etc.

31. Collections have also been made of material for the study of shade trees and cover crops, a gift of a comprehensive set of seeds being gratefully acknowledged from the Director of Amani. Banana stools, for work in connection with coffee culture by native peasants, are also being assembled.

Miscellaneous Work.

32. The station has been entrusted by the Coffee Board with the preparation and issue of a confidential questionnaire to planters with the object of ascertaining the present position of financing in the coffee industry of the Northern and Tanga provinces. The questionnaires were posted during December and in due course the data obtained will be examined and analysed.

33. A preliminary study of the making of compost has been commenced. It is too early to report on methods which are still in a state of flux, sufficient to state that satisfactory material is being obtained in about sixteen weeks.

34. The station is rated as a first-class second order station for meteorological purposes.

Touring.

35. The Chief Scientific Officer, during the course of nine months' residence, has visited most districts in the territory growing arabica coffee, including

some eighty different estates—many of them in connection with the survey work on several occasions. A good general view has been obtained of native coffee culture on Kilimanjaro under the guidance of Mr. C. Harvey, then acting Senior Agricultural Officer and of the work of the Kilimanjaro Native Co-operative Union with the Manager, Mr. A. L. B. Bennett.

36. The District Agricultural Officer (Coffee), has travelled extensively on work in relation to paragraphs 19 to 24 above, and has been mainly responsible for its successful completion for this year.

37. The Chief Scientific Officer, Entomologist and District Agricultural Officer (Coffee), were invited to attend Planters' Days, in July, in Nairobi, when the first and last named read papers which have been published in the East African press *in extenso*.

38. The Mycologist and Chemist accompanied the Chief Scientific Officer to the coffee areas of the Southern Highlands during parts of May and June.

Visitors.

39. Great interest has already been shown in our progress to judge by the numbers of visitors to date. It is gratifying to report that they include numerous planters from Kenya, as well as members of the Departments of Agriculture for Kenya and Uganda.

S. M. Gilbert,
Chief Scientific Officer.

Report of the Agricultural Chemist.

1. The Agricultural Chemist arrived in the territory in October, 1933, and has been stationed at the East African Agricultural Research Station at Amani pending the erection of the laboratories at the Coffee Research and Experimental Station, near Moshi.

2. The extensive number of soil samples collected by the Soil Chemist, Amani, in the course of the East African Soils Survey, include a comprehensive series of the main soil types on which coffee is grown in Tanganyika. These have provided ample material for laboratory study. Much data was already available as to the acidity, organic matter status, clay composition and physical constants of the soils: information has now been sought as to their mineral nutrient status.

3. Numerical data may be more conveniently presented in bulletin form when the work is more complete. In a report of progress one may make certain generalizations, grouping the soils of the coffee belts by districts, which happen to demarcate their chemical properties.

4. *Arusha and Mount Meru.*—The volcanic ash and lava soils are highly saturated with bases. They are neutral to alkaline in reaction, becoming more alkaline in the subsoil. They are very rich in "available" phosphate and in exchangeable potassium. There is a wide range in climate, reflected in the variation in soil maturity, and hence in physical properties. Problems of nutrition may be concerned rather with the balance of the main plant foods than with actual deficiencies of these. Deficiencies of lesser minerals such as manganese and iron may show themselves. The danger of salt toxicity is slight except in the neighbourhood of Engare Nanyuki. The relation between physical properties and soil moisture relations will need study in the field.

5. *Moshi and Kilimanjaro.*—The Kilimanjaro loams are well supplied with exchangeable bases, although more advanced in the degree of weathering. The typical range of acidity at the surface is pH 7·5 to 6·0, becoming more acid in the lower horizons of the profile though seldom falling below a pH of 5·0. Less rich in phosphate and potassium than the Meru soils they are well supplied with these nutrients as judged by ordinary standards. Again, a wide variation in climate is evident, and as one might expect in the drier zones the soils are richer chemically and more alkaline.

6. *Usambaras.*—The soils are more unsaturated with a pH of 6·0 to 5·0 that of the deep subsoil sometimes being as low as 4·3. The exchangeable base content falls off much more rapidly as one descends the profile. Both phosphate and potassium are low. These factors afford an alternative explanation of the poor root growth in the subsoil, to the effect of soil acidity *per se*.

7. *Mbosi.*—The soils are again unsaturated, the range of pH being 6·5 to 5·0, though the pH of the deep subsoil rarely falls below 5·0. Laterization has not proceeded to the same extent as in the Usambaras. The phosphate status is very low but that of exchangeable potassium is high.

8. *Mbeya.*—These soils are less acid than those of Mbosi owing to different geological derivation. The pH range is 7·0 to 6·0; the phosphate status is high at the lower altitudes. Exchangeable potassium is relatively high.

9. The above is a general view of the nutrient status of the chief soils on which coffee is grown in Tanganyika. It is a generalization, based on representative samples, but is not a guide to the manuring of coffee. The nutrient needs of coffee are not known. Where a particular mineral (above) is stated to be low the statement is based on general standards and not on any assumed requirement for the coffee plant.

10. *Salinity of Soils.*—The soils around Mount Meru are chemically rich. The accumulation of soluble salts in the profile was considered a possibility. A number of profiles have been examined, and in only two cases did the concentration of soluble salts reach values which supported a fear of toxic concentrations. In one case, at Usa, a salt concentration of 0·3 per cent. in the immediate subsoil was found: it proved to be calcium sulphate; sodium salts were not present. The other case was that of a profile from Engare Nanyuki, in which at a depth of four feet the concentration of salts was 0·4 per cent., in this case consisting of carbonate, sulphate and chloride of sodium.

11. *Physical Properties.*—On the physical properties of a soil depend the movements of soil moisture in the profile. Although data obtained in the laboratory is not a very reliable indication of conditions in the field it is useful for classification purposes. In an extensive way observations have been made on certain physical constants of the heavier clay soils. It appears that except in *Mbuga** situations the red and chocolate clays are generally flocculated and highly pervious to moisture; they do not exhibit to a marked extent the properties associated with heavy siliceous clays. This applies to certain clays which are only partially laterised, e.g. those at Ngare Nairobi and those at Mbosi where silica/alumina ratios are of the order of 2·3 and 2·2 respectively.

12. *Touring.*—The Conference of Soil Chemists held at Zanzibar in August was attended; also the following coffee areas were toured: West Usambaras, Moshi, Arusha, Mondul, and the South-Western Highlands.

**Mbuga* (Kiswahili) meaning plains.

13. Three weeks were spent on the site of the Coffee Research Station in collecting soil samples for an intensive survey of the station.

14. *General.*—The writer wishes to record his thanks to the Director and staff of the East African Agricultural Research Station, Amani, for hospitality, both official and personal, and particularly to the Soil Chemist, Mr. G. Milne.

H. B. Stent,
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MOROGORO AGRICULTURAL STATION.

1. *Cottons.*—The scheme of cotton selection work started in 1932 has been continued during the present year. Briefly the work consists of the selection of high yielding types from the commercial strain of Upland American cotton grown locally, while at the same time an effort is being made to improve the quality of the lint. Imported cottons have not shown the degree of improvement sought for, and while importations will continue to be made the bulk of the work will be concerned with selection from the local commercial strain. Lint characters of the commercial or ordinary district cotton vary to a considerable extent, but several of the selections originally made in 1932 now show a remarkable degree of uniformity. The most promising strains are—

244.—A fairly tall, strong growing type which together with No. 245 gave the best yields in 1933. This type is not very uniform at present and should provide valuable material for re-selection.

245.—Similar in type to No. 244. Yielded very well in 1933 but has not given so good results in 1934 on account of jassid, white fly and aphis.

249.—A small, early maturing type. Very uniform. Fine wooded and carrying a very good crop of bolls. Damage by jassid very slight. Boll shedding very slight.

250.—Very similar to No. 249 in habit but earlier. Uniform in type.

251.—Smaller and earlier in maturing than the local parent material, although not so early as either No. 249 or 250.

253.—Not so tall growing as either No. 244 or 250, and is a good cropper.

2. The unfavourable climatic conditions experienced during the present year have been of considerable value in detecting strains of doubtful vigour. Jassid (*Empoasca* spp.), white fly (*Bemisia* sp.) and aphis (*A. gossypii*) were present in much greater numbers than in previous years, and it has been possible to discard at an early stage types which have not stood up well to these pests. Selections No. 244 and No. 245 were by far the two best in 1933, yet both were badly attacked by jassid in the present year. These two types possess good lint characteristics and will be retained for re-selection for jassid resistance.

3. *Progeny Plots of 1933 Selections.*—Of the selections made in 1933 the following were planted out in progeny plots during the present year. Nos. 38, 39, 311, 314, 321, 315, 316, 317 and 318 have been discarded and those remaining are enumerated in the table set out below :—

Selection No.	Weight of 100 seeds lint	Weight of 100 seeds	Lint index	Ginning percentage	Lint length ins.
32	9·2	5·6	3·6	39·1	$1\frac{1}{4}$
33	10·4	6·9	3·5	33·6	$1\frac{1}{8}$
34	14·0	8·8	5·2	37·0	$1^{3}/_{16}$—$1\frac{1}{4}$
35	12·9	8·4	4·5	34·9	$1\frac{1}{8}$—$1^{3}/_{16}$
36	10·8	6·1	4·7	43·5	$1\frac{1}{8}$
37	10·8	6·8	4·0	37·0	$1\frac{1}{8}$
310	9·6	6·2	3·4	35·4	$1\frac{1}{8}$—$1^{3}/_{16}$
312	9·8	5·8	4·0	40·8	$1\frac{1}{8}$
319	11·8	7·8	4·0	33·1	$1\frac{1}{4}$
320	11·9	7·9	4·0	33·7	$1\frac{3}{8}$
322	9·6	6·2	3·4	35·5	$1\frac{1}{8}$—$1\frac{1}{4}$

4. *Long-staple Types.*—In 1933 three plants were selected from the local commercial cotton of a different type to the local strain of American Upland. These possess very good characteristics as the following table shows :—

Selection No.	Weight of 100 seeds lint	Weight of 100 seeds	Lint index	Ginning percentage	Lint length ins.
37	20·06	13·50	6·56	32·7	$1\frac{1}{4}$—$1\frac{3}{8}$
38	17·24	11·54	5·70	33·0	$1\frac{1}{4}$—$1\frac{3}{8}$
322	20·94	13·84	7·10	33·9	$1\frac{1}{4}$—$1\frac{1}{2}$

These were planted out in progeny plots in the present year and have shown a considerable amount of variation. There exist within this group plants possessing a lint length of $1\frac{1}{2}$ins., the lint is particularly strong and silky and free from "nep"; there are also plants showing a very high resistance to attack from jassid and white fly with a yield of seed-cotton considerably in excess of individual plant yields of ordinary district cotton. Thus it should be possible in the near future to fix a type combining the good qualities of the group. Of the selections made from this group during the present year No. 468 (ex No. 322) has bred true for a maximum lint length of $1\frac{3}{8}$ to $1\frac{1}{2}$ins. while it also possesses a habit of growth suitable to local conditions.

5. *Single Plant Selections made in 1934.*—Selections have been made from ordinary district cotton, from progeny plots of 1933 selections and from multiplication plots of 1932 plants. A considerable degree of uniformity has now been obtained in the 1932 selections, and improvement is now being sought within these types rather than by selection from outside sources.

(*Note.*—A table similar to that in paragraph 3 above is omitted.—Director.)

6. *Moco cotton.*—The Moco cotton (*G. purpurascens*, Poir.) received from Dr. Harland, Trinidad, in 1933 has not given very good results during the present year. The plants were vegetative in habit compared with those of Upland American, the bulk of the plants being $4\frac{1}{2}$ feet in height. The plants suffered severely from insect attack as the following report of the Assistant Entomologist shows :—

> "The following insect pests were noted on the Moco cotton adjacent to the Laboratory :—
>
> *On Stem.*—The small weevil (*Apion xanthostylum*) was present early in the season ringing the branches, which later split away from the stem. It is considered probable that Apion will prevent the establishment of any perennial cotton in Morogoro as it is believed that this pest has been brought down to its present level by attention to maintenance of a dead season for cotton—unidentified termites attacked the less thrifty plants during the rains. Termites are not usually found attacking cotton in this district, particularly during the growing period, and may be taken as indicative of the poor state of the cotton—the mealy bug *Ferrisia virgatus* was found in numbers on several plants.
>
> *On Leaf.*—Jassids (*Empoasca fascialis*), white fly (*Bemisia* sp.), and a hitherto unrecorded leaf hopper (Psyllidæ) were common. Aphis was present. With the exception of the leaf hopper, all of these insects have been numerous on the district cotton.
>
> *On Bolls.*—Moths of the scavenger worm (*Pyroderces coriacella*) and the seed worm or grain moth (*Corcyra cephalonica*) were reared from bolls which had not opened normally."

Only a very small amount of seed-cotton was obtained from these plants in this their second year of growth. Most of the bolls opened very badly and internal boll rot was particularly severe. The maximum lint length obtained was $1\frac{1}{8}$ins., the ginning outturn being 24·7 per cent. The plants have been

ratooned during the present dry season and will be retained for trial in 1935.

7. *Sorghums.*—An attempt has been made during the present year to classify the local types of sorghum and to obtain data on relative yielding capacities. Several types exist from the loose panicled hard-grain type to the close headed, very soft-grained varieties. Four main types exist—

(1) *Karachi group.*—White grained; white or yellow glumes: open headed.
  (i) Karachi: smallish grained, open panicle; glumes projecting.
  (ii) Bangala or Bunhula: small grained, glumes projecting.
  (iii) Shware: large seeds entirely filling glumes; glumes yellow.

(2) *Jebere group.*—White grained, black glumes, open headed.
  (i) Jebere: white grained, black glumes; good storing properties.
  (ii) Gundogundo: probably synonymous with Jebere; smaller grain.
  (iii) Kikoroti: yellow or black glumes.

(3) *Kobero group.*—Reddish brown grain, black or yellow glumes, open head.
  (i) Kobero: brownish grain, glumes black or straw colour; large grain.
  (ii) Mdula: grain reddish, glumes black.
  (iii) Mrunha: brick-red grain, chocolate coloured glumes.

(4) *Kihemba-usungu group.*—Reddish grain and glumes; close head; not eaten by birds.
  (i) Kihemba-usungu: reddish grain and glumes; close head.
  (ii) Katembo: small reddish grain; close head.

Group No. 1 contains the high priced varieties, of which Karachi and Bangala are the most typical representatives. Jebere is the predominant variety in the hills although Kobero (a higher yielding type which was formerly grown there) is no longer planted and a re-introduction of this type should prove advantageous. Kobero is a large grained type, immune to attack by birds, which fetches a comparatively high price. Selected plants have been made from the following varieties this year: Karachi, Bangala, Jebere, Kobero.

8. *Maize Variety Trial.*—Certain of the recent productions of maize hybrids in South Africa were received here for trial purposes together with some of the recognized standard varieties. These were tested out during the year, using Potchefstroom Pearl as control:—

Analysis of variance:

Due to	Degrees Freedom	Sum of Square	Variance	½ log.
Treatments	9	3660	406·6	3·00391
Blocks	5	95	19·0	1·47221
Error	45	1630	36·2	1·79452
Total	59	5385		

Calculated value of Z = 1·20939. Observed value of Z (1%) = 0·5254.

Treatment means (per acre):

Peruvian	733·5lbs.	Sire Cross	1,325·0lbs.
Bœsman	905·5 ,,	Anveld	1,350·0 ,,
Natal 8-row	1,250·0 ,,	Ladysmith White	1,550·0 ,,
Synthetic I	1,283·5 ,,	Hickory King	1,741·5 ,,
Chester County	1,316·5 ,,	Potchefstroom Pearl	2,116·5 ,,

A difference between any pair of treatment means of 340lb. is significant, therefore—

(i) Potchefstroom Pearl has given a significantly higher yield than any other variety.

(ii) Hickory King is superior in yield to all varieties except Potchefstroom Pearl and Ladysmith White.

(iii) There is no significant difference in yield between Synthetic I, Anveld, Sire Cross, Natal 8-row and Chester County.

The difference in yield between Potchefstroom Pearl and Hickory King is surprising since the two are usually regarded as practically equal yielders. The new varieties Synthetic I and Anveld have not shown up well against the standard varieties. Peruvian, Bœsman, Natal 8-row and Chester County are yellow flint maizes more suited to drier conditions, and consequently they have not shown up particularly well.

9. *Maize Manurial Trial.*—A simple manurial trial was laid down in the multiplication block of White Cango maize in order to test the increased yield obtained from the use of farmyard manure. The trial took the form of a half drill strip experiment, the manured plots receiving farmyard manure at the rate of eight tons per acre in December before the land was ploughed. Planting took place in March, using a Ransomes two-row "Pilot" planter. The application of the farmyard manure has given a significant increase in yield of 444lb. grain per acre, or an increase of over 28 per cent.

(*Note.*—Details of statistical interpretation are omitted.)

10. *Sisal Cultural Experiment.*—A sisal cultural trial was laid down in 1933 to determine the relative effects of various field treatments in the growth of sisal. The experiment took the form of a randomized block, there being five replications of the six treatments employed.

The treatments are—

No. 1 : Weeds allowed to compete with sisal.
No. 2 : Cover crop (*Crotalaria striata*).
No. 3 : ,, ,, (,, *anagyroides*).
No. 4 : Scuffling.
No. 5 : Deep cultivation.
No. 6 : Scuffling plus nitrogenous fertilizer.

A difference between any pair of treatment means which is greater than 5·1 leaves per plant is significant, therefore—

(i) All treatments are significantly better than No. 1.

(ii) Treatment No. 2 is significantly inferior to treatment No. 3.

(iii) There is no significant difference between treatments Nos. 3, 4, 5 and 6.

(*Note.*—Details of statistical interpretation are omitted.)

The difference in growth in treatment No. 1 was most marked, and as this is the treatment given to a great deal of the sisal in the territory the lesson is obvious. The sisal plants were much smaller than in any of the other treatments, the leaves shorter and of a sickly, yellow colour while suckers were produced at a much lower rate. The poorer growth resulting when weed growth is allowed to compete with the sisal appears to be due to the competition between the roots of the sisal and those of the weeds, since the roots of both were found to inhabit the top six inches of the soil. The cover crops employed have been eminently successful; both are deep rooted and therefore do not compete with the sisal roots. Both are bushy in habit, i.e. non-climbers, and it is interesting to note that *C. anagyroides* was attacked only very slightly by adult locusts while the attack on plants of *C. striata* was fairly severe. These cover crops can be cut back at the end of the year to encourage more bushy growth of the plants and at the same time to provide a green mulch. Both set seed freely under local conditions.

11. Observations have also been made on leaf and root growth, and it has been found that root growth takes place from December to May and June in each year while leaf growth follows root growth at an interval of one and a half to two months. No root growth was evident in the dry season, i.e. after the end of June, and no leaf growth was detected after the height of the dry season, i.e. July/August. It would appear, therefore, that no cultivation should be done in the rainy season in order not to disturb the growing sisal roots, and that the weed growth should be cut out at the beginning of the dry season in order to provide an effective mulch, and that suppression of the weed growth be continued (in the dry season) until the break of the rains. No appreciable difference was evident between treatments Nos. 3, 4, 5 and 6, and should there be no gain by deep cultivation this should certainly be replaced by a shallow cultivation (in the dry season) just sufficient to control weed growth. The application of the nitrogenous fertilizer gave no material increase in leaf production.

12. *Cover Crops.*—A series of trials of cover crops has been conducted at Morogoro during the last few years in order to test cover crops suitable for local conditions. Madagascar Butter Bean has given consistently good results over a number of years, and is considered by far superior to any of those tested. In addition to forming an effective ground cover which persists right through the dry season it provides a seed of value both for food for human consumption or as an export crop. The following table gives the weights of green matter per acre obtained from the plots this year :—

Madagascar Butter Bean	8½ tons.
Dolichos lab-lab	4¼ ,,
Lima Bean (*Phaseolus lunatus*) ...	2 ,,
Sunn Hemp	1 ton.

13. *Cattle.*—A dairy herd of Friesian and Ayrshire grade stock has been maintained at the agricultural station since August, 1932, the animals being mostly three-quarter bred. The main difficulty encountered in the keeping of this grade herd has been the incidence of Trypanosomiasis (chiefly *T. congolense*), and although actual losses have been kept low by means of systematic treatment the incidence of the disease has been remarkably high. Milk yields of the grade herd have averaged 3,112lb. per animal in a lactation, the maximum yield recorded being 5,289lb. Three of the native cows have been in milk during the present year, the best yielder giving close on one gallon per day and bidding fair to equal the average yield per lactation for the grade herd.

14. The animals are maintained on grazing only during the rainy season but are stall fed throughout the dry season. The Edible Canna has proved invaluable since both leaves and rhizomes can be fed to the stock. Madagascar butter bean as mentioned has also proved of immense value in the stall feeding of the cattle, while it is also possible to graze this crop. The most useful component of the grazing area here is *Panicum maximum*, a grass which gives a very high yield and is readily eaten by stock. Recently, an area has been planted up with Rhodes Grass (*Chloris gayana*) to provide a grass suitable for hay-making, while a local species of *Digitaria* which grows readily in certain hill parts has been planted at the station.

15. The work oxen have done excellent service in reducing costs of cultivation on the station, all the land now being ploughed by this means. Ransome's "E.C.A." ploughs have proved the most useful type, but a light type of plough (Ransome's "Hindustan") which can be pulled by two oxen has given very encouraging results in preliminary trials. It is capable of turning

a good furrow and can bury green manures or farmyard manure effectively. It is estimated that this plough (ironwork only) can be supplied locally for Shs. 14/-, which is remarkable value in comparison with the cost of the "E.C.A." plough. Also, six oxen are usually required for the "E.C.A." while two are sufficient for the "Hindustan." This type of plough will be used in the peasant holdings to be established at Morogoro.

Planting Material Received.

Tomato seed "Matchless"	1lb.
Canadian Wonder Bean	2 kilos.
Porto Rico Yam	1 parcel.
Cotton seed U/4 bulk	3 bags.
,, ,, "920"	1 bag.
,, ,, "998"	1 ,,
,, ,, "955"	1 ,,
,, ,, U/4/2	5lb.
,, ,, U/4/4/2	5 ,,
,, ,, U/4/4/2, 955	5 ,,
,, ,, N.3	5 ,,
,, ,, N.10	5 ,,
,, ,, Z.14	5 ,,
,, ,, C.28	5 ,,
Seed potatoes, "Kerr's Pink"	3 tons.
,, ,, "Abundance"	2cwt.

Planting Material Distributed from Morogoro Agricultural Station.

MAIZE:

Potchefstroom Pearl	1,970lb.
White Cango	2,840 ,,

LEGUMES:

Madagascar Butter Beans	13¼ ,,
Fiwi Bean (Dolichos lab-lab)...	¼ ,,
Lima Bean	65¼ ,,
Pigeon Pea	8 ,,
Velvet Bean	¼ ,,
Cowpea	19 ,,
Crotolaria striata	¼ ,,
Crotolaria juncea	¼ ,,

FRUIT TREES:

Mango	41
Orange	101
Marsh's Seedless Grapefruit	145
,, ,, ,, (budwood)	1 parcel.
Mulberry	63
Lime	45
Lemon	43
Tangerine	289
Mandarin	100
Citron	65
Breadfruit	33
Spondias Plum	6
Avocado	83
Guava	129
Litchi	28
Carambola	34
Soursop	10
Sapodilla	61
Cherimoya	23

FRUIT TREES:—*contd.*

Custard Apple	12
Bullock's Heart	35
Almond	21
Sweetsop	1
Nartje	26

MISCELLANEOUS:

Rosa damascena cuttings	1,190
Rose cuttings	108
Peru Balsam	5
Geranium	6
Criollo cacao	18
Coffea arabica	15
Edible canna rhizomes	$3\frac{3}{4}$ bags.
Pawpaw seeds	1lb.
Cassava cuttings	1 bundle.
Grevillea robusta	15lb.
Khus-khus grass roots	10 bags.
Acalypha sanderiana	8
,, *marginata*	8
,, *macrophylla*	9
Allamanda	16
Angelonia	9
Barbadoes Pride	11
Eranthemum	22
Frangipani	14
Hibiscus	45
Ipomœa	3
Oleander	11
Poinsettia	22
Russelia	22
Croton	71
Cassia nodosa	10
,, *alata*	4
,, *siamea*	seeds.
,, *Fistula*	,,
Oreodoxa	8
Tecoma stans	seeds.
Sesbania grandiflora, seeds	30lb.
Bœhmeria nivea	1 parcel.
Gliricidia maculata	cuttings.
Holmskioldia sanguinea	,,
Cedrela odorata	seeds.
Adenanthera pavonina	,,
Ixora coccinea	3
,, *radiata*	3
Prosopis juliflora	seeds.
Quisqualis	6
Spathodea	16
Bougainvillea	4
Bambusa	6
Datura arborea	4
Peltophorum ferrungineum	12
Buddleia variabilis	2
Iron Bark pumpkin	2lb.
Bamboo setts	12

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UKIRIGURU AGRICULTURAL STATION.

Programme of Work.

In addition to carrying on the trials started in 1932-33 a number of new experiments were laid down. Strain trials of the most promising 1932-33 selections were also carried out. With the exception of cotton, fewer field selections were made than the previous year as the materials on hand are as much as can be properly treated with the present staff and facilities.

EXPERIMENTAL RESULTS.

The following trials were carried out :—

I. A and B : Cotton Strains.
II. Mass selected versus Local Cotton.
V. Short Sorghum Varieties.
VI. Wiru Sorghum Varieties.
VII. A and B : Medium and Tall Sorghum Varieties.
IX. Native versus Virginia Bunch Groundnut Variety.
X. Inhibition of Rosette Disease of Groundnuts.
XIV. Residual value of manuring Pennisetum.
XV. A and B : Awned versus Native Bulrush Millet.
XVII. Residual effect of Green Manuring.
XIX. Manuring of Pennisetum.
XX. Manuring of Cotton.
A. Rice Variety Trial.
B. Strain Trial Sena Mtebe.
C. Strain Trial Bungala.

Experiment No. I.A.

(1) Strain trial of 1932 selections.

(2) Treatments. Strain Nos. 604, 527, 553, 559, 572, 576, 437, 579 and control of district cotton.

(3) Lay-out. Randomised Block, Plots 1/40 acre, five replications.

TABLE I.

Strain	Seed-cotton ozs. per Plant	Order of Merit
604	1·854	VIII
527	2·072	VII
553	2·191	IV
559	2·170	V
572	2·999	I
576	2·225	III
437	2·278	II
579	2·106	VI
Control	1·711	IX

Standard error of difference between two treatments = ·177
Difference required for significance (P. = ·05) ... = ·347

Experiment No. I.B.

(1) Strain Trial 1932. Field selections.

(2) Strain Nos. 561, 655, 602, 570, 613, 509, 580, and control of district cotton.

(3) Lay-out as in I.A.

TABLE II

Strain	Ozs. per Plant	Order of Merit
561	1·941	I
655	1·558	IV
602	1·348	VI
570	1·752	II
613	1·414	V
509	1·206	VII
500	1·513	III
Control	1·137	VIII

Standard error of difference between two treatments = ·199
Difference required for significance (P. = ·05) ... = ·370

Owing to the low incidence of insect pests and the dry atmosphere little disease was present, not sufficient properly to test the strains.

Experiment II.

Mass Selection Trial.

(1) Object. To ascertain the value of mass selection of local cotton.

(2) Treatments—

(a) Seed of 15 selected strains mixed together.
(b) Seed of mass selections of local cotton.
(c) Local cotton seed control.

(3) Lay-out. Randomised block. 6 replications. 1/40 acre plots.

Treatment	Yield in ozs. per Plant	Difference from Control	Order of Merit
Selected Strains	1·315	·451	II
Mass selection	1·576	·712	I
Local	·864	—	III

Standard error of Means = ·1475
Difference required for significance = ·3286

Summary.—The significant increase in yield over control obtained by both treatments very markedly points out the weakness and mixed character of the local cotton and indicates that a rapid method of improving the yield of local cottons is available. This year cotton was remarkably free from disease and pests and there was no real testing of the disease resistance of the two selections.

Experiment No. V.

Mass Selection Trial.

Short Sorghum. Variety Trial.

(1) Treatments. Seven varieties. Bukura wa Bakara, Shimbewanera, Kabunde, Kuja, Mwanakwimba, Nandele, and Kipamabajinga.

(2) Lay-out. Randomised Blocks. 4 replications. 1/40 acre plots.

TABLE III.

Variety	Mean yield ozs. per plant	Order of Merit	Striga Factor	% Borer
Mwanakwimba	2·401 ...	I ...	16 ...	26·7
Shimbewanera	2·248 ...	II ...	14 ...	23·2
Kipamabajinga	1·940 ...	III ...	20 ...	27·3
Kuja	1·859 ...	IV ...	12 ...	28·2
Nandele	1·137 ...	V ...	10 ...	27·3
Kabunde	·601 ...	VI ...	14 ...	33·6
Bukura wa Bakara ...	·594 ...	VII ...	8 ...	56·3

Standard error of difference between two varieties = ·138
Difference required for significance (P. = ·05) ... = ·291

Summary.—Owing to the difficulty of obtaining an even stand due to dry conditions it was necessary to take the mean yield per plant.

Bukura wa Bakara, the lowest yielder, shows a very high count of stalk borer but as it is quick maturing its low yield is not due to this damage

The striga factor was estimated on the quantity of striga appearing in the plots; the whole area was heavily infested. The high yield of Mwanakwimba is surprising as it has been recognized as a low yielder. The dry year and consequent low incidence of Downy Mildew may be the cause as this variety is highly susceptible to the disease.

Experiment No. VI.

Wiru Sorghum. Variety Trial.

(1) Treatments. Magohe, Nyawawa, Yemba, Boya, Bumabele, Bwiru of Ukerewe and Bukura Masara.

(2) Lay-out. Randomised Blocks. 4 replications. 1/40 acre plots.

TABLE IV.

Variety	Mean yield ozs. per plant	Order of Merit	Striga Factor
Bukura Masara	2·069 ...	I ...	20
Boya	1·312 ...	II ...	20
Nyawawa	1·044 ...	III ...	8
Bwiru of Ukerewe ...	·975 ...	IV ...	20
Bumabele	·965 ...	V ...	8
Magohe	·937 ...	VI ...	24
Yemba	·879 ...	VII ...	18

Standard error of difference between two treatments = ·120
Difference required for significance (P. = ·05) ... = ·252

Summary.—The Wiru Sorghums are mostly grown in the Lake Shore areas; they are a close open headed type. In this year's trials they have shown a greater resistance to striga than any other types, the mean factor for the Wirus being 17 as compared with 23 for others. Nyawawa and Bumabele have given very low striga factors; the result for Nyawawa confirms native opinion of this sorghum and appears a valuable variety as it is also a fair yielder.

The control, Bukura Masara, is not a Wiru sorghum being a close headed red grained type with the reputation of a high yielder. The control being a significantly higher yielder would place the virus as medium yielders in type, but with many valuable characteristics the most important of which is their suitability for growing on light soil areas. They could with advantage displace the low yielding Pennisetum on such soils.

The grain of the Wirus is white, makes good flour and stores well but the loose open heads are susceptible to damage by birds.

Experiment No. VII A.

Variety Trial. Tall Sorghums.

(1) Treatments. Nzanza; Nzazani, Solyu, Mwessa, Nyaweraka, Nghollongo Igogo lya Ngombe, Bukura Ngoa, Ndulugunya, Bukura Masara Control.

(2) Lay-out. Randomised Block. 4 replications. 1/40 acre plots.

TABLE V.

Variety	Mean yield ozs. per plant	Striga Factor	Mean % Borer	Order of Merit
Nzanza	·774	10	56·9	III
Nzazani	1·800	14	25·1	I
Bukura Masara...	·869	26	29·2	II
Nyaweraka ...	·742	24	24·6	IV
Ndulugunya ...	·645	26	23·1	V
Bukura Ngoa ...	·631	24	26·8	VI
Nghollongo ...	·619	30	21·8	VII
Solyu	·470	28	32·3	VIII
Mwessa	·431	30	27·0	IX

Standard error of difference between two treatments = ·435
Difference required for significance (P. = ·05) ... = ·669

Summary.—In this experiment striga infestation was high and resulted in great variation in yield from plot to plot and comparison of yields is difficult. The three lowest yielding sorghums all have light coloured grains and are highly palatable varieties. Their resistance to striga is poor compared to the red grained types all of which show lower striga counts. Stalk borer counts, with the exception of Nzanza, do not show a wide range. Nzanza, although badly attacked by borer, occupied a high place in the order of merit. The early maturity of this variety has probably enabled the plants to form heads before the borer did vital damage.

Experiment No. VII. B.

Variety Trial Medium Height Sorghums.

(1) Object. To ascertain the best varieties.

(2) Treatments. Varieties :—Kishitangino, Boya, Bukura Mahemba, Ngalya, Nyahaliwanoni, Kanyanga, Nghollongo tembe, Kabili, Bukura Masara Control.

(3) Lay-out. Randomised Block. 4 replications. 1/40 acre plots.

TABLE VI.

Variety	Yields in ozs. per plant	% Stalk Borer	Striga Factor
Nyahaliwanoni	·848	28	28
Boya	·763	27·1	22
Bukura Mahemba ...	·756	21·4	18
Bukura Masara	·662	20·7	26
Nghollongo tembe ...	·515	36·2	24
Kanyanga	·493	33·5	24
Kishitangino	·463	20·7	28
Ngalya	·414	24·0	34
Kabili	·354	13·9	28

Standard error of difference = ·2121

Summary.—(1) In this trial as in other sorghum variety trials the heavy infestation of striga has caused great variability in yields and non-significant results.

(2) The two lowest yielders, Ngalya and Kabili, are both saccharine sorghums.

(3) There is no apparent correlation between either per cent. stalk borer and yield or striga resistance and yield.

Experiment No. IX.

Variety Trial of Native versus Virginia Bunch Groundnuts.

(1) Treatments. Native groundnuts of mixed types and Virginia Bunch groundnuts.

(2) Lay-out. Half drill strip. 8 replications. Plots 1/40 acre each.

	Native groundnuts		Virginia Bunch
Mean Yields ...	716 lbs. per acre	...	601 lbs. per acre

Standard error of mean = 32·79.

Summary.—The yields given are pounds kernels per acre. The native groundnuts which consist of a number of types mixed together are significantly higher yielders than the quick maturing Virginia Bunch.

In 1932 the results of a trial between the native types and Virginia Bunch were greatly in favour of the native varieties.

The dry season has greatly reduced the superiority of the native types and has shown that there is a definite place in native agriculture for the Virginia Bunch groundnuts as they can be planted late without losing the crop.

Native groundnuts, although better yielders, must be planted early otherwise they are likely to be a complete failure and it happens only too often that native cultivators find it impossible to get food and cash crops planted early enough.

Experiment No. X.

Inhibition of Rosette Disease of Groundnuts.

(1) Object.—To ascertain the effect of close spacing and wide spacing; clean cultivation and leaving weedy, on the incidence of rosette disease of groundnuts.

(2) Treatments:—

(a) 24″ apart, left weedy;
(b) 6″ apart, clean cultivation;
(c) 24″ apart, clean cultivation;
(d) 6″ apart, left weedy.

Virginia Bunch groundnuts planted. Weedy treatments also sown with teff grass to obtain good weedy growth.

(3) Lay-out. Latin square 4′ × 4′. 25′ × 25′.

Mean Percentage of Rosette Disease affected Plants.

6″ weedy	6″ clean	24″ clean	24″ weedy
·305 ...	1·185 ...	2·775 ...	21·042

Standard error of mean of 4 plots = 2·2863
S.E. × 3 = 6·8508

Analysis of Treatments.

	Mean Difference	S.E. of Mean of 4 Plots
(1) Effect of weediness versus effect of clean weeding	9·573 ...	2·284
(2) Effect of close spacing versus effect of wide spacing	11·163 ...	2·284

Summary.—The effect of close spacing was greatly to reduce the incidence of rosette disease but the difference between leaving weedy and clean cultivation

on close spaced plants was not significant. With wide spacing the rosette disease on the weed plots was significantly less than on clean cultivated plots.

Natives of Zanaki in Musoma district practice delayed weeding; this practice is with the spreading native groundnuts which are wide spaced. No cultivation is given until the groundnuts reach a vigorous growing stage and begin to cover the ground. That this is a sound practice, provided the weed growth is not of an undesirable type, is confirmed by the experiment.

With an erect type of groundnut such as Virginia Bunch practising as close a space as possible commensurate with cultural requirements, is indicated.

Experiment No. XIV.

Residual Value of Manuring of Pennisetum.

(1) Object.—To ascertain the increased yield obtaining from the previous year's application of 7 tons per acre of kraal manure.

(2) Lay-out. Faulkner system. 8 treatments, 9 controls. 1/40 acre plots. Crop Native Pennisetum.

Treatments. 7 tons per acre kraal manure applied season 1932-33. Control no dressing.

Mean Yield in Lbs. per Acre.

	Control	Treatment	Difference
Mean ...	487 ...	730 ...	243

Standard error of mean difference = 16·96

S.E. × 3 = 50·88

Mean Number of Tillers per Plant.

	Control	Treatment	Difference
Means ...	2·487 ...	3·617 ...	1·130

Standard error of mean difference = ·2402

S.E. × 3 = ·7206

Summary.—The residual value of the application of seven tons per acre of kraal manure applied to a crop of pennisetum the previous year has given a significant increase in yield over control when again cropped with pennisetum. Although the yields of both control and treatment plots were much below the previous year, yields of both local native crops and farm pennisetum were low, the percentage increase due to the residual value was greater than the increase obtained the year before.

Per cent. increase of treatment plots over control—1932-33, 33; 1933-34, 49.

The residual fertility or improved texture of the soil has allowed plants on the treated plots to make good growth even under the very dry conditions which prevailed.

The increase in the number of tillers per plant of treated plots over untreated was again significant. Both control and treated plots were harvested on the same date but actually the treated plots matured some days earlier than the control.

Germination of the treated plots and growth throughout the season was better than control and in the latter stages a striking ocular demonstration to natives.

Experiment No. XV.

Variety Trial of Awned versus Native Pennisetum.

(1) Object.—To ascertain yields and characteristics of two varieties.

(2) Treatments:—

(a) Native Pennisetum (*P. tyhoidum*).

(b) Awned Pennisetum (*P. spicatum*).

(3) Lay-out. Half drill strip. 1/40 acre plots. One trial on heavy soil replicated on light soil.

A. Heavy soil.

Yields of Grain in Lbs. per Acre.

	Native	Awned	Difference
Means	776 ...	780 ...	4

Standard error=49·8

The difference was less than the standard error.

B. Light soil.

Yields of Grain in Lbs. per Acre.

	Native	Awned	Difference
Means ...	1,133 ...	1,148 ...	15

Standard error=35·4

The difference was less than the standard error.

Summary.—(1) No significant difference in yield between the two types was obtained.

(2) The awned millet was introduced on account of its reputation of being immune to damage by birds. It has been found that this is not entirely correct for although a large number of short billed birds are unable to damage the heads, long billed birds do not seem to find difficulty in reaching the grain.

(3) Great variability in the degree of awnedness was observed and there are possibilities of obtaining a strain more resistant to the damage.

(4) A certain quantity of seed of the awned type was distributed last season and was favourably spoken of by native cultivators as what resistance it has to birds is of great value.

Experiment No. XVII.

Residual Effect of Green Manuring.

(1) Object.—To ascertain the residual value of a green manure crop applied before planting Virginia Bunch groundnuts the previous year.

(2) Treatments. 1932-33—

(a) Sunn hemp planted and dug in 46 days later;

(b) No treatment control.

Virginia Bunch groundnuts planted.

(3) Lay-out. Faulkner system. 8 treatments, 9 controls. 1/20 acre plots. Cropped 1933-34 with Pennisetum.

Yields of Grain in Lbs. per Acre.

	Control	Treatment	Difference
Mean	730 ...	788 ...	58

S.E.=18·01.

Difference exceeds 3 times the S.E.

Weight in Ozs. per Head.

	Control	Treatment	Difference
Mean ...	·412 ...	·417 ...	·005

S.E.=·0185.

Difference less than S.E.

Number of Plants per Plot.

	Control	Treatment	Difference
Mean ...	·619 ...	·652 ...	33

S.E.=9·04

The difference exceeds 3 times the S.E.

Summary.—A significant increase in yield of grain due to the residual value of the previous year's green manuring was obtained. The previous

year the digging in of the green manure was found neither to increase or lower the yield of the crop of groundnuts which followed it and where it is desired to incorporate green manure in a rotation it is proved possible to plant the green manure crop before early maturing groundnuts with advantage.

The increase in yield was not attributable to either increase in weight of seed per head or the number of tillers per plant. Although all plots were thinned down to one plant per hole a greater number of plants on the treated plots reached maturity due to some factor such as improved soil texture or greater resistance to disease.

Experiment No. XIX.

Manurial Application Trial.

(1) Object.—To ascertain the economic dressing of kraal manure applied to pennisetum.

(2) Treatments—

(a) 2 tons per acre
(b) 5 ,, ,, ,,
(c) 8 ,, ,, ,,
(d) Control. No dressing.

(3) Lay-out. Latin square 4′ × 4′. 1/40 acre plot

Yield in Lbs. per Plant.

Treatment	Treatment and Means	Value of T. P. =·2	Difference for Control
Control	·0897	·011	—
2 tons per acre ...	·0904	—	·0007
5 ,, ...	·0991	—	·0094
8 ,, ...	·1032	—	·0135

Summary.—From this trial there is only an indication that the yield is increased by a dressing of 8 tons per acre of kraal manure. This is in conflict with the marked results obtained from Experiment XIV in 1932-33 and 1933-34. It is thought that owing to the very dry season the dry kraal manure did not break down sufficiently to be available for plant food.

The result of Experiment XX on the manuring of cotton also gave non-significant results.

Experiment No. XX.

Manurial Application. Trial Cotton.

(1) Object.—To ascertain the most economic dressing of Kraal manure on cotton.

(2) Treatments :—

(a) 3 tons per acre
(b) 6 ,, ,, ,,
(c) 9 ,, ,, ,,
(d) No dressing.

(3) Lay-out. Latin square 4′ × 4′. 1/40 acre plots. Crop local cotton.

Treatment	Yield in ozs. per plant	Difference for Control
3 tons per acre	·781	+ ·007
6 ,, ...	·736	— ·038
9 ,, ...	·803	+ ·029
Control	·774	—

Standard error of Mean of 4 plots=·042

Summary.—No significant increase in yield was obtained from any of the dressings applied.

The results of this experiment and the manuring of pennisetum have shown that the use of unmade kraal manure, in a dry year, are negligible. However, it has been shown by Experiment XIV that in favourable years the use of a dressing of 7 tons per acre of the same type of manure has given a valuable increase in yield.

Experimental Rice Plots, Mwanza, 1933-34.

Strain trials were carried out between the most promising selections. Seed of all strains was from a selfed plant. All plots had single plant stands and the yield per plant has been taken in all strain trials.

In addition to trials of local varieties and strains a number of introductions were tried out. Unfortunately damage by birds spoilt these trials.

Rice Variety Trial.

(1) Object.—To ascertain the yield of established local varieties.

(2) Treatments.—Varieties. Majimaji, Sena, Bungala, Afaa, Sena ya Bukwimba.

(3) Lay-out. Randomised Blocks. 4 replications.

Analysis of Significant Difference.

Variety	Yield in Ozs. per plant	Sena ya Bukwimba	Majimaji	Afaa	Sena (ordinary)
Sena ya Bukwimba ...	1·304	—	—	— ·326	— ·470
Majimaji	1·133	—	—	—	— ·299
Afaa	·978	+ ·326	—	—	—
Sena (ordinary) ...	·834	+ ·470	+ ·299	—	—
Bungala	·503	+ ·801	+ ·630	+ ·475	+ ·331

Standard error of Mean ... ... =·0622
Difference required for significance (P.=·01) =·269

Significant Difference between Mean Tiller Counts.

Variety	Tiller means
Afaa	9·76
Majimaji	9·04
Sena (ordinary)	9·07
Sena ya Bukwimba	8·72
Bungala	3·54

Standard error of Mean ... ... =·4036
Difference required for significance (P. =·05) = 1·24

Summary.—Under the particular conditions represented, Sena ya Bukwimba is significantly higher than all but Majimaji; Bungala significantly lower than all.

The yields of Sena ordinary and Majimaji confirm the yield trial between these varieties carried out in 1933 in which the superiority of Majimaji was proved. Sena ya Bukwimba is only grown in a limited area but the results of this year's trial warrant further investigation into its quality.

Sena Mtebe Strain Trial.

(1) Object.—Selection of good strains.

(2) Lay-out. Randomised Block, 4 replications, single plant stands. 10″ × 10″ apart.

(3) Treatments.—Selfed seed of eight strains selected in 1932.

Analysis of significant differences between Strains and Control.

Strain Number	Yield per plant		Number of tillers per plant		Weight of panicle	
	Means in ounces	Differences from Control	Means Number of tillers	Differences from Control	Means in ounces	Differences from Control
SM. 32014	·975	·269 S	7·34	·95	·130	·022
SM. 32023	·939	·233 S	8·11	1·72 S	·115	·007
SM. 32012	·869	·163	6·72	·33	·131	·023
SM. 32016	·859	·153	6·61	·22	·129	·021
SM. 32011	·771	·075	5·97	— ·42	·124	·016
SM. 32013	·766	·070	6·08	— ·31	·125	·017
SM. 32008	·719	·023	6·18	— ·21	·115	·007
SM. Control	·706	—	6·39	—	·108	—
SM. 32005	·696	·010	7·49	1·10	·092	— ·016
Value of 'T' for 5% point = ·190		Value of 'T' P.= ·05 = 1·78			Value of 'T' P.= ·05 = ·078	

Inspection of the above table shows us that the high yield of S.M. 32023 is accounted for by a significantly higher number of tillers whilst that of S.M. 32014 is accounted for in part by tillering and in part by a high panicle weight. These latter differences, however, are not significant and must be taken as tentative conclusions only. The table for panicle weight suggests that there is a wider opportunity for improvement by selecting for this factor than for a higher tiller count, in the case of the variety Sena Mtebe.

Strain Trial, Bungala.

(1) Selection of good strains.

(2) Lay-out. Randomised Blocks. 4 replications single plant stands. 10″ × 10″ apart.

(3) Treatments. Selfed seed of eight strains and control of local seed.

Analysis of significant differences between Strains and Control.

Strain Number	Yield per plant		Number of tillers per plant		Weight of panicle	
	Means in ounces	Differences from Control	Means Number of tillers	Differences from Control	Means in ounces	Differences from Control
BU. 32012	1·219 S	·370 S	8·33 S	3·23 S	·582 (— S)	— ·085
BU. 32018	1·198 S	·349 S	7·08 S	1·98 S	·674	·007
BU. 32004	1·120 S	·271 S	6·12	1·02	·737 (+ S)	·070
BU. 32011	1·118 S	·269 S	7·09 S	1·99 S	·626 (— S)	— ·041
BU. 32009	1·016	·167	6·00	·90	·671	·010
BU. 32006	·998	·149	6·01	·91	·673	·006
BU. 32008	·871	·022	4·75	·35	·741 (+ S)	— ·074
BU. Control	·849	—	5·10	—	·667	—
BU. 32013	·803	— ·046	4·35	·75	·744 (+ S)	·077
Value of 'T' = ·212 P.= ·01		Value of 'T' P.= ·01 = 1·96			Value of 'T' P.= ·01 = ·028	

Examination of the above table shows that in three cases out of four the higher yields of the best strains, compared with control, are accounted for by a higher number of tillers per plant whilst only in one case is higher yield

due to weight of panicle. In three strains out of four, panicle weight is very low indeed. This would lead one to think that judicious selection within the progeny of useful plants of these strains of plants with high panicle weight might enhance the yielding qualities of those strains, if the factor for large numbers of tillers is not lost in doing so. The reverse applies to strains Nos. 32003 and 32018. It will be noticed that the strains are listed in order of yield. The close manner in which the tiller counts also follow the strains in descending order in an orderly manner and the appearance of significantly low panicle weights away the higher yielders and the reverse among the lower yielders, tentatively suggests a positive correlation ; in the case of Bungala, between tillers and yield.

Selection Work.

Cotton.

The selections brought forward from the 1932 progeny plots have shown considerable promise in the two strain trials carried out this year. In addition to most giving significantly higher yields than the control of local cotton, with one exception, No. 32527 ; all have shown fair disease resistance.

Most plants are of a good type and medium in stature, only one, No. 52553 being rather tall. The following four selections are outstandingly good :—

Strain No.	Disease Resistance	Vegetation Habit	Stature
32576	Fair	Good	Medium
32553	Fair	Good	Tall
32561	Good	Good	Short
32570	Good	Good	Medium

Strain No.	Lint Length	Ginning %	Position in Yield Trial	
32576	$1\frac{1}{8}''$	33·4	III	1A
32553	$1\frac{1}{8}''$	32·1	IV	
32561	$1\frac{1}{8}''$	31·3	I	1B
32570	Full $1\frac{1}{8}''$	34·6	II	

All selections are being planted in a yield trial next year.

The field selections of 1933 were planted in progeny plots ; these numbered sixty. A large number were discarded by eye although further single plant selections have been taken from them ; seven of the remainder are to be planted in a strain trial. Two of these, Nos. 33520 and 33457, were outstandingly good in the progeny plots.

Over four hundred single plant selections were made in the field during the season but further examination led to the discarding of a number and one hundred and twenty are to be planted in progeny plots ; in addition reselections from last year's progeny plots are to be tried.

Groundnuts.

Selection work has not yet led to any improvement. The single plant selections taken last year were planted out in progeny plots but no increase in yield was obtained. Reselections have been made within the different types and these, with further selections from the District Agricultural Officer, Maswa, are to be again planted.

Attempts have been made to find a nut suitable for markets such as confectionery and roasting. Local types have been well spoken of and if further shipments prove their suitability supplies will be stimulated.

The following varieties were under observation :—

Variety	Date planted	Date lifted	% Rosette	Type of plant	Size of nuts
I. Virginia Bunch	20/12	10/4	25	Upright Bunch	Small seed, red
II. Akola ...	,,	10/5	18	Upright	Small seed, brown
III. Basse	,,	15/5	16	Runner	Small seed, reddish brown
IV. Phillipine White	,,	15/5	8	Runner	Small seed, dirty white
V. Mamaye ...	,,	24/5	15	Upright	Large seeded, light skinned
VI. Kalande ...	,,	24/5	30	Runner	Large seeded, red
VII. Mwitunde ...	,,	24/5	27	Semi-upright	Medium size seed, light brown
VIII. Manyema ...	,,	10/5	20	Upright	Small seed, brown

Rices.

A number of selections from different varieties have been undertaken and selections of two varieties have in this year's trial proved much superior to local seed.

Results of Trials :

Sena Mtebe. Strains Nos. S.M. 32014 and S. M. 32023 are outstanding in yield. No. S.M. 32014 has a particularly large panicle and has unfortunately rather weak straw. No. S.M. 32023 is more erect with a higher tiller count but is slightly later in maturing.

Bungala. Four strains, Nos. BU. 32012, BU. 32018, BU. 32004, and BU. 32011 have proved significantly higher yielders than control. Tiller counts in these strains are high and panicle weight low. No. 32012, the highest yielder, is the most promising ; although a little later than the others it has a very stocky and upright growth.

Majimaji. The failure to obtain superior strains of the variety is disappointing as it is the most extensively grown variety and large numbers of selections were made. Mm. 32056 was a higher yielder than control but no significance exists. As a variety majimaji shows less variability than others.

Strain Trial, British Guiana Rices :

A strain trial was carried out between a number of rices received from British Guiana. Owing to damage by birds no significant results were obtained ; the mean yields from the two undamaged blocks were as follows :—

Variety	Yield in Ozs.	Order of Merit
No. 79	75 ...	V
No. 75	73 ...	VI
Ran Capain	78 ...	IV
Demerara Creole	105 ...	1 and II
Blue Stick	105 ...	1 and II
Majimaji	80 ...	III

The following observations were made :—

No. 79 Very poor development. Height 1'6". Plants rosette in type. Days to maturity, 142.

No. 75 Fair development. Height 2'. Days to maturity 140.

Ran Capain. Fair development. Height 2'. 140 days to maturity. Red sheath and glumes.

Demerara Creole. Fair development. Height 2′5″. Tillers well. 150 days to maturity.

Blue Stick. Very good development. Height 2′. An upright variety showing very strong tillering. Days of maturity, 154.

The variety Blue Stick showed great promise in its first year although later than all the others.

Majimaji Strain Trials :

Two strain trials, 1932 selections of Majimaji were carried out but no significant increase in yield was obtained from any of the selections.

Afaa Strain Trials.

The results of the strain trials carried out with selections of Afaa were valueless owing to drainage from an incinerator spoiling a number of plots.

Cassava.

Some varieties of cassava were reputed to be resistant to a "wilt disease" which has done considerable damage in recent years but none are completely so. In order to obtain new strains which might carry greater resistance a large number of seedlings were raised ; none of these have shown complete resistance but three of the strains have shown a fair degree and further efforts on these lines are to be continued.

Observations on Introduced Crops.

Edible Canna.

The need for a satisfactory stock feed is of paramount importance and edible canna has shown itself to be very valuable when well treated. Under good conditions rapid growth is made providing a large quantity of feed ; the green growth unfortunately does not persist into the dry season.

Difficulty was experienced in getting stock to take it but once they had done so it was eaten with relish.

Except where irrigation is possible its extension seems limited to areas of good rainfall.

Elephant Grass.

Although not an introduction the treatment of elephant grass as a fodder crop has been tried for the first year. Good results were obtained, growth was satisfactory and large yields obtained. When growing strongly, cuttings were made at 2½ months' intervals, and the best results were obtained by cutting very close to the ground. Growth continued longer into the dry season than that of edible canna and did not deteriorate so rapidly. No difficulty was experienced with the feeding of it.

Grasses.

The following grasses which were planted in 1933 have shown little promise with the exception of African Foxtail which has done better from seed than from the cuttings :—

Star Grass gave poor growth.
African Foxtail was fair.
Giant Guinea Grass failed.

Further species were planted in 1934. Finger grass, Star grass, Giant Guinea grass and Kuruman Strain A have made very moderate growth. Finger grass and Kuruman A are the best.

Pigeon Pea.

Five strains of pigeon pea introduced from India are highly promising. No yields were obtained until the end of the year as they were badly attacked by flower eating beetles. All strains showed very good development, much

superior to local strains. Leaf and flower development was very good, unfortunately damage allowed only a small quantity of seed to set.

Broom Corn (*Holcus Sorghum*).

The trial of Broom Corn has shown definite promise, the crop grew well and was ready for cutting in 92 days, a great deal of variation in the types of head led to an uneven sample and selectors were made of the best and allowed to set seed.

The best heads were over two feet six inches in length and when properly dried were of a good colour and pliable in nature.

A number of brooms were made for trial and proved satisfactory.

A sample sent home was favourably commented on and a larger sample is to be tried again.

Timing of Native Cultivation.

Although records were taken of the labour spent on the Native Holdings at Ukiriguru last year's method of timing the labour expended on three of the most important crops was repeated.

The times given are those including cultivation, planting and harvesting.

Crop	Days	Yields lbs.	Return	Shs.	Cts.
Sorghums	7 ...	600	Food		
Cotton...	23 ...	346	... 11 Cts. =	38	00
Groundnuts, Virginia Bunch ...	18 ...	364	... 4 „ =	14	56
Groundnuts, Native	19 ...	300	... 4 „ =	12	00

The timings from the farm headman's plot, on which labour expended is recorded, is given :—

	Days	Yields lbs.	Return
Maize	22 ...	1,440 ...	Food
Millet	17 ...	512 ...	Food

D. Thornton,
District Agricultural Officer.

Annexure XI.

THE LUBAGA EXPERIMENT STATION.

General.

1. An area comprising thirty acres of land was earmarked for experimental purposes and 205 acres were planted with bulk crops to provide seed reserves for the native administration. In addition twenty-four acres were late planted with maize for the making of ensilage and produced sufficient green material to fill four pits, each with a capacity of approximately 1,700 cubic feet. An excellent and adequate food supply was thus made available for the ploughing oxen during the dry season.

2. Net profit handed to the native administration during the current year totals to date over £150, making an average profit for the four years during which Lubaga has been in existence of over £120 per annum. Additional profit for this year is also represented in the considerable tonnage of groundnuts, maize, millets and other seeds still in the stores and available for sale or free distribution to native cultivators.

3. The season was unfavourable; the rainfall being poor in total precipitation and badly distributed.

Maintenance and Development.

4. The experimental area, comprising thirty acres, was completely enclosed with a barbed-wire fence, thus ensuring complete freedom from trespass by both cattle and natives. Small buck have, however, frequently penetrated the barrier, but the damage done was inconsiderable.

5. Implement and general sheds were added to the existing stores and provide good accommodation and temporary shelter during harvesting operations. A large circular threshing floor was constructed of cement and thus facilitates the production of clearner seed and also eliminates a certain amount of supervision previously required to prevent mixing of seed. A manure shed, constructed of mud brick and thatch, was unfortunately carried away during a storm.

Materials were purchased with which to erect a cow shed, but owing to lack of water a temporary grass shelter was considered more advisable until such time as a water supply can be made available.

6. The provision of a water supply received careful attention and every avenue was explored, but our efforts were nullified owing to the prohibitive cost of boreholes. Expert advice regarding the location of water was called in and a trial well dug. A depth of one hundred feet was attained but our efforts were unsuccessful in finding water.

7. The unfavourable season accounted for the poor germination and growth of tree seeds planted on the roadsides. Although replanting was carried out three times, and watering resorted to, only about one per cent. have become established. In provision for next season a large number of Cassia seedlings have been raised in pots and will be planted *in situ* when the rains commence.

Experimental Lay-out.

8. The half drill strip and randomized block methods were adopted for groundnuts and cotton, and in all experiments provision for "end row effect" was made.

Maize.

9. A plot of mass selected maize was planted on the 8th January and yielded 872lb. per acre. Cobs of outstanding size and apparent purity were selected from the exhibits at the Shinyanga Show, and yielded as follows:—

Characteristic of	Yield per acre lbs.
(1) Flint Red Variety	1,433
(2) ,, ,, ,, ...	1,006
(3) Potchefstroom Pearl	1,164
(4) White Cango	991
(5) Potche Pearl	1,128
(6) White Cango	1,479
(7) Potchefstroom Pearl	869
(8) White Cango	610
(9) ,, ,, ...	1,220
(10) ,, ,, ...	976

The above figures serve to demonstrate that attention is required in the selection and improvement of the heterogeneous collection of maize at present grown by natives of this area.

Millets and Sorghums.

10. In view of requests by natives for a bird and witch-weed resistent type of millet a bulk plot of awned bulrush millet was laid down. Excellent growth was made and comparative freedom from ravages by birds noted. The incidence of witch-weed (Striga sp.), however, showed little difference between that of adjacent plots of sorghums. The yield per acre was 1,060lb. As a demonstrational plot some sixty selected types of sorghums were planted but suffered severely from attacks by stalk borer (*Busseola fusca*, Hmpsn.).

Groundnuts.

11. A half drill strip experiment was laid down to compare the yields of the Virginia Bunch groundnut with that of a type called *Kalanda*, chosen as being representative of the one in more general use throughout the district. The results are given hereunder:—

Standard error	2·42
Probable error	1·63
Probable error of the mean of ten differences ...	0·51

There is thus a significant result in favour of Virginia Bunch groundnuts of 9·8 plus-minus 0·51lb. from one-fortieth-acre plots. Rosette disease in all the plots was insignificant and germination was good. Demonstrational plots of groundnuts gave the following yields:—

	lbs. per acre
(1) Mixed sample	1,052
(2) Mwezi	736
(3) Bluish tinted nut	315
(4) Mbalala	544
(5) Kalanda	378

12. Prime importance was attached to a half drill strip experiment to test the capabilities of Mwanza cotton seed against those of U/4/4/2, the present bulk crop of the district, but from the outset the experiment was attended by misfortune. Germination of the Mwanza seed was quicker by reason of the fact that it contained a good percentage of naked seeds whereas U/4/4/2 is heavily fuzzed. Both varieties suffered severely from attacks by caterpillars, and in spite of constant hand-picking irreparable damage was done to the seedlings. The plants were thinned to two plants per hole, but patchy germination and losses due to caterpillars eventually rendered the experiment effective as such. Replanting of the gaps was carried out and a sufficient stand obtained to show the characteristics of the two varieties. It was clearly evident that although jassid infestation was by no means great U/4/4/2 was the better resister.

13. A randomized block of Barberton selections was planted, but as planting was delayed until February on account of the late arrival of the seed no results were obtained.

Variety Trials.

14. Variety trials with small quantities of seed received from the Gatooma Cotton Station, Southern Rhodesia, resulted as follows:—

Variety	Yield per acre lbs.	Lint Length ins.	Ginning Out-turn %	Lint Index	Weight of 100 seeds grms.
U4/64/V	459	1	32·2	4·25	8·64
U4/64/7/10	422	$1^{1}/_{16}$	29·8	3·725	8·32
U4/64/1/2	294	$^{29}/_{32}$	31·36	4·037	8·229
U4/26/B/2	312	$^{7}/_{8}$	35·56	3·66	7·72
U4/34/2/1/3	385	$^{27}/_{32}$	30·0	3·97	8·26
U4/78/3/5/2	367	$1^{1}/_{32}$	35·7	4·41	8·41
U4/34/2/1/2	385	$^{29}/_{32}$	31·16	3·925	8·28
U/4/4/2	367	$^{15}/_{16}$	34·29	4·402	7·87

The U/4/4/2 represents the check rows planted for end row effect either side of the above series. Germination of all the varieties was exceedingly good, due to the fact that the seeds had previously been defuzzed with acid. The plants were smaller in stature than all others on the station, and after the first flush of bolls died off completely.

15. *Lubaga Selections.*

Variety	Yield per acre lbs.	Lint Length ins.	Ginning Out-turn %	Lint Index	Weight of 100 seeds grms.
L. 1	164	$^{15}/_{16}$	32·77	4·32	7·94
L. 2	202	$^{29}/_{32}$	33·27	4·36	8·43
L. 3	312	1	32·76	3·865	7·67
L. 4	146	1	30·36	4·085	9·2
L. 5	137	1	35·0	4·395	7·635
L. 6	275	$1^{1}/_{32}$	35·22	4·39	7·96
L. 7	357	$^{31}/_{32}$	35·0	4·54	7·71
L. 8	385	$1^{1}/_{8}$	36·12	4·33	7·535
L. 9	284	$1^{1}/_{32}$	35·88	4·14	7·322
L. 10	184	1	34·22	4·11	7·9
L. 11	128	$1^{1}/_{32}$	32·4	3·48	7·28
L. 12	311	$^{31}/_{32}$	36·24	4·23	6·91

The above were selected for lint length in which factor they are each fairly regular. Reselections for improvement of yield will be made next season.

Barberton Selections.

16. The varieties given below have been "kept going" for three years at Lubaga with a view to utilization for selection work. Natural crossing has occurred but nevertheless the record is interesting :—

Variety	Yield per acre lbs.	Percentage stained	Variety	Yield per acre lbs.	Percentage stained
U/4/4 ...	322	62	Cambodia ...	430	53
U/4	404	67	U/4/64 ...	427	37
H/67	137	68	U/4/64/7 ...	383	45
Z.9	342	63	U/4/4/10 ...	367	50
C.15	383	64	H/77 ...	403	54
Z.14	504	52	U/4/26/4 ...	387	69

Bulk Crops.

17. Cotton seed from the original Barberton stock of U/4/4/2 reproduced only at Lubaga was utilized in the planting of 134 acres. It has been previously stated that sixty acres of this was completely destroyed by caterpillars and was replanted. The stand was extremely patchy owing to unfavourable conditions, and in addition lack of suitable labour for picking was responsible for a considerable loss of crop; thus the resultant yield per acre over the whole area is considered satisfactory. A considerable increase in yield could have been obtained from the "top" crop, but labour conditions did not permit its harvest.

The final figures for the crop sold were :—

Grade I	Grade II	Grade III	Mixed
19,282lb. ...	14,821lb. ...	8,700lb. ...	2,907lb.

Total output = 46,410lb., including 700lb. in stock or used for other purposes. Yield per acre = 346lb.

Other bulk crops yielded as follows :—

	Lbs. per acre
Velvet Beans	803
Sword ,, ...	816
Lima ,, ...	228
Matt ,, ...	504
Groundnuts	513

18. Experimentation under the semi-arid conditions which have prevailed throughout the past season has resulted in much truncation of effort but nevertheless has been typically demonstrative of the fact that underlying aims and objects of all selective and improvement work should be based on the capacity of the plant to adopt itself to changing local environmental conditions.

H. Marsland,
District Agricultural Officer.

Annexure XII.

IHEME AGRICULTURAL STATION.

1. The completion of the two dwelling houses on the station was carried out. Owing to the late return from leave of the District Agricultural Officer the full building programme foreshadowed last year could not be put through, but the building materials have all been purchased and are ready for erection in the new year when the rains cease.

2. A water furrow from a lake south of the Iheme valley is nearing completion. A new fire-curing barn was begun; a conditioning cellar was dug and a new cattle house was also commenced. A native house was erected for training apprentices in tobacco curing.

3. Composting manure by the Indore method, as modified in Nyasaland, has been carried out with success. There are two cattle houses being used in the process, each housing twenty-five head of cattle. The process has been modified to fit in with the farm work, and although it took longer for the material to break down than in Nyasaland it has been cheap, costing Sh. 1/- to Sh. 1/50 per ton in labour.

4. Conditions were dry at the beginning of the season, good planting conditions did not occur until January.

5. *Fire-cured tobacco.*—The pure line selection commenced three years ago is being carried on with the Nyasaland variety Heavy Western. Of this, seed was produced for sale and distribution.

6. *Blue Pryor.*—This variety was planted for observation. It shows no superiority over Heavy Western and there seems no object in continuing with it.

7. *Heavy Western seed imported from Nyasaland.*—This was planted as a check to compare with the crop grown from our own pure line selections. No difference is recorded.

8. *Flue-cured tobacco.*—A variety trial of Amorello, White Stem Oronoco and Hickory Pryor was laid out in a Latin square. The experiment will have to be repeated to obtain significant results.

9. *Turkish tobacco.*—Planting of the twelve varieties mentioned last year was repeated. Samples were taken by the District Agricultural Officer to England when he proceeded on vacation leave and were submitted to tobacco brokers. Messrs. Maxwell, Macmillan and Company report regarding the variety Xanthi Yaka: "... The largest users of this type of tobacco in the country report that the smoking qualities of this variety are better than any previous samples from your district, and it is probable that it could be used in small quantities. They add, however, that they doubt the keeping qualities of the tobacco; nevertheless they would very much like to have a bale or so kept in storage for a year before deciding whether this class of tobacco would be suitable for their needs." In consequence of the above a planting will be made and a shipment sent of one or two bales.

10. *Peas.*—A variety trial was carried out, using the Latin square method, with the following results :—

	Average yield per plot ozs.
(1) Uluguru Round	145
(2) ,, Wrinkled	101
(3) Russian Field	72
(4) Black-eyed Susan	90

Small game damaged the plots hence no calculations are submitted. Observation shows clearly, however, that the Uluguru round pea is superior to the remainder. The experiment is being repeated.

11. *Cutworm Experiment.*—The following treatments were carried out :—

(a) Sodium fluoride 6½oz., 2gal. water, 2gal. of chopped-up prickly pear.

(b) Paris green 1lb., bran 60lb. mixed and moistened; applied 20lb. per acre.

The experiment is to be repeated.

12. *Wheat.*—Variety trials of wheat were carried out at Nguruhe by Mr. Paul Egger, but results were rendered unreliable owing to damage by game. Varieties Nos. N.B.2(6)3 and B.256, however, appeared to be outstanding.

13. Trees have been planted in windbreaks or in blocks for trial. Since tree-planting at Iheme commenced three years ago, and since the station has supplied trees each year for planting up the streets in Iringa township, tree-planting is increasing everywhere.

14. The following are under trial on plots or in the nursery :—

Cossack Alfalfa
Crested wheat grass
Glycine Max (Soy bean)
Manchurian Soy bean
Porto Rico yam
Canna Edulis
Crotalaria Striata
Kudzu vine
Pecan nuts
Queensland nuts
Aleurites Montana
Grape vines
Various fruit trees.

15. As will be seen from the foregoing the experiment work is very restricted in view of the development work still being carried out and is also handicapped by too new soil that has not yet had time to be worked up, and by the ravages of game. It is emphasized that the Iringa soils must be put in good heart and a good tilth obtained before accurate and comprehensive results can be obtained.

C. J. McGregor,
District Agricultural Officer.

Annexure XIII.

REPORT OF THE AGRICULTURAL LECTURER ON THE NYAKATO AGRICULTURAL TRAINING CENTRE.

Staff.

1. Mr. A. E. Haarer is the Agricultural Lecturer in charge; he was relieved by Mr. H. Gillman, District Agricultural Officer, on proceeding on vacation leave on the 1st of December. The native staff consists of one native industrial instructor, a native teacher, a ploughing instructor, also a clerk, field headman, messenger, cook and one other.

2. The popularity of the school is shown by the fact that over sixty applications have been received for the next two-year course commencing on the 1st February, 1935. These included two from Musoma District and one from Korogwe in the Northern Province. The Reverend Father Mors of Kashozi Mission writes :—

"Since the people have understood that the Nyakato School is of good discipline further boys have asked me to help them gain admission."

3. From a commencing complement of sixty pupils a total of fifty-five boys finished their course. Four had been expelled because they were of bad influence and one in failing health was sent home two months before he died of tuberculosis.

4. Of the fifty-five the head boy Stanislaus is being placed at Nyakato next year at a small commencing wage as an assistant teacher. Fifteen of the most promising boys are given permission to remain for a third year. The remaining forty-four boys having finished their course now leave Nyakato. They can be considered to have a good all-round knowledge of essential agricultural practices, the improvement and proper treatment of the soil, and more especially the correct cultivation of coffee. They are in the category of trained peasant farmers, which it is the primary aim of Nyakato School to produce. A list of them with full particulars has been supplied to the district agricultural office so that their future progress can be followed up in the field.

Teaching.

5. The pupils have been receiving academic schooling through Standards III and IV given them by Teacher Benedict. The papers were set by the Education Inspector, Mwanza. Teacher Benedict has closely followed my agricultural courses and is now capable of assisting in teaching coffee cultivation, soil treatment and elementary plant physiology. For ease in teaching the pupils are divided into two classes of not more than thirty each.

6. The industrial instructor has been assisting in teaching rough masonry and carpentry. The boys have been taught to make such things as coffee drying trays, step ladders for picking coffee, handles for knives and saws,

water wheels and the erection of a coffee factory, sheds and *bandas* for the drying of hides, roller cane matting for shading nursery beds, paddock gates and cattle byres.

7. The ploughing instructor has taught the cutting, twisting, softening and preparation of reins and the training of oxen. Mechanical implements for use in cultivation are being collected together for demonstration and use in future.

8. Co-operation between the Veterinary and Forestry departments has given better facilities for the teaching of animal husbandry and forestry work, in fact animal husbandry is now featured next to coffee in importance at the school. The shortage of timber in the district both for firewood and for building in connection with a peasant farmer's existence makes it important that he should be taught the correlative value of tree planting and a wiser exploitation of natural forest growth.

9. Both in the classroom, by demonstration, and in the field the boys have had a thorough grounding in elementary plant physiology to give them understanding of the requirements of a plant and of their various economic crops. Teaching of all subjects has continued to serve the most important industry of the district, i.e. coffee production, and in this second year the boys have been encouraged and have been willing to carry out far more practical work in the field. A labour gang is still in use to carry on the rough development work in the various fields but all the maintenance and the more important and technical work such as soil treatments, planting, sowing, reaping and such is carried out by the pupils.

Health.

10. We are fortunate in being close to a medical officer and the Bukoba Native Hospital. It is imperative that the closest attention must always be given to the health of pupils at a boarding school such as Nyakato. Dietary irregularities may cause alarming symptoms of an epidemic nature as happened once during the year, when prompt action and diagnosis is necessary. Epidemics of measles and chicken-pox were saved on two occasions by immediate isolation of suspects and acceptance of certified cases in Bukoba Hospital. The insidious introduction of venereal disease was checked and controlled by medical examination at the beginning of each new term, and the strict confining of pupils within bounds during term time. All the obstinate wounds, hurts and doubtful illnesses have been taken to Bukoba Hospital for treatment.

11. We must therefore thank the medical officer and his staff for a great deal of assistance and co-operation. Only the most simple ailments have been treated at Nyakato. Medical supplies for these have been given us without stint and have been issued under the direct supervision of the Agricultural Lecturer. Our pupils have therefore mainly enjoyed good health. They have gained in weight and stature and have been quite satisfied with their rations and the attention they receive. Regular feeding, regular physical exercises, regular spells of outdoor work in the fields have no doubt contributed to their well-being.

Pupils' Allotments.

12. Pupils have each had small plots of land to terrace and cultivate for themselves. They have generally been enthusiastic in cultivating such crops as cassava, potatoes, beans, cabbages, carrots, tomatoes and groundnuts.

13. The preparation of two acres of land for robusta and one for arabica coffee was completed in time for planting in the big rains. Both areas were divided into four strips and prepared in the following ways :—

Robusta Plot:

Strip A dressed with twenty-five tons decayed compost and surface dug.

Strip B bastard trenched using thirty tons of farm-yard manure. Subsoil worked to depth of over two feet. Bottom "spit" brought to the surface and dressed with manure at rate of five tons to the acre.

Strip C dressed with twenty-five tons farm-yard manure and surface dug. Top dressed with compost at rate of five tons per acre.

Strip D given no manure. Surface dug and subsoil forked to depth of two feet.

Arabica Plot:

Each strip was treated in the same fashion but on account of smaller size were dressed with correspondingly smaller amounts of manure and compost.

14. Planting was completed in the big rains by the pupils. There are six varieties of robusta and four varieties of arabica. Four lines of each are planted across the variously prepared strips and spaced fifteen feet apart. In accordance with the plan, discard lines have been arranged for. Although the plants took some while to establish themselves growth is now quite satisfactory.

15. Subsequent treatment has been the mulching of strip A and D with cut grass, and the "flooding" of strips B and C with groundnuts for green manuring. All noxious weeds have been eliminated whilst some of the valuable ones for purpose of green manure and cover are being encouraged. The plots should soon be of absorbing interest not only to pupils but to adults and to European planters of the district. Training of the more advanced arabica plants to systems of "single stem" and "multiple stem" has begun.

16. Bananas of the local food variety, to supplement rations and to shade the coffee, have been planted in diagonal system throughout both plots. Alternate lines have been planted and are being treated native fashion versus modern west Indian method. The latter is recently showing promise of a great advance over native methods. The bananas planted on strips B (bastard trenched) have shot ahead of the others and have created a profound impression on natives of the vicinity.

17. Cuttings of *Erythrina lithosperma* the dad-dap of Ceylon, obtained from Arusha, are being propagated for interplanting with the bananas on strips B (intensive culture). It is the shade that gives best promise for Bukoba District and has its near cousin *Erythrina tomentosa* growing indigenously in the neighbourhood.

18. The following surplus coffee plants were distributed for planting in the district :—

Through the District Agricultural Officer	700
To the Bethel Mission	250
Total ...	950

19. In order to assist the District Agricultural Officer in raising plants for distribution and to demonstrate nursery practice seed was sown in November to raise 5,000 arabica plants for the 1935 planting season.

20. With the assistance of the pupils an earth dam was thrown across the small stream in the valley to create a head of water sufficient to work a small coffee factory. Concrete foundations, abutments and shutes were then made, and a four-foot diameter undershot waterwheel put together in our workshop was placed in position and found to give when working at full pressure approximately two horse power. A roof was built above and the side filled in with wire netting. A $2\frac{1}{2}$-sized baby coffee pulper and a No. 6 Africa coffee huller were then installed and connected by shaft, chain and sprockets to the waterwheel. A pump, pipes and overhead tank were fitted to give a water supply to the coffee pulper.

21. The work, which was begun in February, was not completed until August. We were then too late to catch the arabica coffee season for which the factory has been primarily built. The wet preparation of arabica coffee should give an enhanced price that will attract the native to bring his coffee for treatment. When this has been effected we can then deal with robusta coffee. The factory is compact and efficient and has already caused interest in the district.

Forestry.

22. A headman and labour as requisite have been supplied through the co-operation of the forestry officer for raising batches of Eucalyptus plants for seasonal distribution and planting from a section of the Nyakato School nursery. We have distributed 10,700 pot plants during the year.

23. So much rough timber is used for firewood and farm constructional work that it is imperative to arrange for our own supply at an early date. We have much steeply sloping land of poor soil where trees can be planted to bring increased fertility and stop soil erosion. The work is an object lesson and constant demonstration to pupils and natives of the district. The work of raising plants, planting and care is all in the hands of the pupils. The following plants have been raised for planting, and about a third of the available land has been planted :—

Eucalyptus citriodora pot plants	21,479
,, ,, root and shoot cuttings ...	6,000
Total ...	27,479

24. Natives of the district practice the periodic cutting down of all timber and vegetation in the valleys and along stream beds or shading springs. This suddenly threatened our coffee factory when natives began to cut a tract of jungle forest on land outside our boundary but immediately above the dam. It was obvious that the flow of water would not then remain so constant and a promise had been made us to preserve this vegetation. Representations were made to the administration and cutting has been stopped. It has been suggested that further tree planting to extend this valley cover and proper exploitation of the timber supplies for the benefit of the interested natives, might be under the control of the school to form a demonstration that is badly needed in the district.

Stock.

25. The zebu cattle brought from Musoma by the veterinary officer at the end of last year were successfully acclimatized. The new cattle byre was completed and the cattle installed and taught to submit to halter. Regular grazing, watering, stall feeding and care have been taught. The five oxen

have been trained for working. The stock now housed at Nyakato are as follows :—

Stock	Owner
2 Ankole milch cows	Agricultural Department.
2 Ankole bulls	Chief Ruhinda.
6 Ankole milch cows	,, Ruhinda.
2 Ankole milch cows	,, Lwaijumba.
2 Zebu bulls	Veterinary Department.
10 Zebu milch cows	Veterinary Department.
4 Zebu milch cows	Agricultural Department.
2 Ankole calves	Chief Ruhinda.
3 Zebu calves	Veterinary Department.
5 Zebu oxen	Veterinary Department.
38 head	

26. Two tons of rich farm-yard manure is produced per month and this is increased by the addition of more grass and farm refuse. We have made and used during the year approximately 45 tons of farm-yard manure and 110 tons of compost.

A surplus milk supply under the control of the veterinary officer has been sold to a value of Shs. 263/40.

27. The Nyakato hide drying shed situated within the school has continued in operation under our supervision and guidance during the year and forms a neat and valuable demonstration. The hides are brought here and prepared by local butchers who arrange co-operative sales and may take away their hides at any time after these are dry : 476 hides were dealt with.

Grazing.

28. The "Kikuyu" grass has been propagated to such an extent that we now have a large stock patch and seven quarter-acre paddocks already planted. Three more paddocks are prepared in readiness. The Kikuyu grass is an undoubted success provided it is hand weeded for a short while after planting and is dressed with a sufficiency of manure. The grazing then obtainable is as fine as anywhere in the territory. Supplies of planting material have been distributed to the Bugufi administration, two Bukoba Chiefs and two Bukoba settlers.

29. Seed of acid-tolerant clovers collected on Kilimanjaro was recently inter-sown in the Kikuyu grass paddocks. It has germinated but does not as yet promise to be successful. Home clovers, both red and white, that were tried in the nursery failed on account of soil acidity. At the request of the veterinary officer trial beds were sown with the grass *Paspalum dilatatum*. This germinated well but then died away, presumably on account of climatic or soil conditions. It was tried on both ordinary and heavily manured soil.

30. *Edible canna* has been extensively propagated and planted. Provided it is manured and replanted every two years it grows wonderfully at Nyakato and is giving us heavy yields of green fodder for stall feeding. Supplies of planting material have been given to the District Officer, Biharamulo, two Bukoba Chiefs, the Bethel Mission and one Bukoba settler.

The few plants of Kudzu vine remaining from last year's sowing, were stationary for a long while. They have recently sprung into growth and now promise success.

31. The paddock of *Melinis minutiflora* spent itself in seeding and made a straggling, wiry growth that is of no use. It was hoped that this indigenous

grass would succeed on the soil without manuring. We had not enough manure to spare, otherwise I am sure that the grass would succeed and give excellent grazing for calves. It may be possible to try again in the future. Though heavily manured the paddock of Guinea grass would not stand cutting for stall feeding nor grazing and is considered a useless grass for Bukoba conditions. It is evident that success is obtainable with Kikuyu grass for grazing and edible canna for stall feeding, and hence we shall concentrate on these two plants in future and disregard less promising ventures, with the exception perhaps of the Kudzu vine.

32. The four paddocks set aside for the improvement of the natural poor grazing by forking, manuring and cutting to weaken the tufted grasses, so that the underlying turf may be encouraged, are giving promise of ultimate success. The grazing is already much improved. It is obvious that it will take longer than was at first thought. A second application of manure and another year's patient wait must be persevered with before regular grazing can be attempted. Impatience and attempts to graze too early are often to blame for the ruination of grazing demonstrations.

Ecological Work.

33. Mr. H. Gillman, District Agricultural Officer, has carried out work on the natural grasses, more particularly as regards plant succession and community following fire, cultivation and manuring.

Soil Erosion.

34. The terraced plots were developed to demonstrate (a) proper control of soil erosion (b) the proper cultivation and spacing of crops of value in the district (c) the terrible poverty of the soil and the urgent need to manure (d) proper crop rotation, and (e) the economic use of the soil by constant cropping and interplanting. Legumes have followed root crops, herbaceous crops have followed legumes, and cereals have followed herbaceous crops on all the six series of ten plots each. In every series of ten plots five have been alternately manured in the proper way for comparison. Crop residues have been dug in or turned into compost and returned to the soil. An effort is being made to find a suitable legume that will grow without manuring on the alternate plots and bring the soil to fertility without other manurial applications.

35. These plots have increased in value in each succeeding month when successive manurial applications have had time to show their effect. Five plots of each series are now in good condition. We are now able to grow valuable food crops on land that would never have produced them before, and yields are jumping. Both in ocular fashion by comparision of growth and mentally by comparison of yield we are hammering into the minds of the pupils and natives of the vicinity the benefits accruing from proper soil treatment.

36. The following crops have been under demonstration :—

English Potatoes	Tomatoes.
Sunflowers	Buck wheat.
Cow peas	Pigeon peas.
Maize	Kidney beans.
Velvet beans	Groundnuts.
Madagascar Butter Beans	Earth peas.

The beneficial effects of proper soil management are even now discernible, and comparisons with control plots are obtained by actual weighings of yields.

Orchard and Vegetable Garden.

37. A fruit orchard was begun during the year to demonstrate the cultivation of various fruits and to encourage more fruit growing within the district. Material for propagation and distribution will ultimately be available. Sweet bananas (three varieties), citrus (four varieties), carambola, soursop, bullocks-heart, large Chinese mulberry have been introduced, in addition avocado pear, pawpaw, passion fruit; American blackberry, wineberry and tree-tomato.

38. Vegetables have been grown extensively between the rows of fruit trees. Pupils have already taken a liking to such vegetables as cabbage, carrots, onions, tomatoes, pumpkin, seeds of which have been given them. The variety of plants give valuable material for classroom demonstration.

Lectures and Publications.

39. Both the veterinary and forestry officers have given and submitted a course of lectures on their separate subjects. The Agricultural Lecturer has completed the courses under the heads (a) coffee cultivation (b) elementary plant physiology (c) agricultural practices. The first has been written up for record and has been published in *Mambo Leo*. The second is in course of preparation and fifteen lectures have been submitted for publication in *Mwanafunzi*.

Visitors.

40. Many visitors have inspected the school, including His Excellency the Governor and the members of the Parliamentary Commission. European settlers as well as missions are taking an interest in the demonstration fields and far more adult natives are now visiting the school. The African agricultural instructors came for a special demonstration of coffee planting by arrangement with the District Agricultural Officer. Fifty schoolboys from Kashozi Mission and twenty-five village schoolboys from Maruku also visited the school.

Recreations.

41. The pupils have formed first and second eleven football teams and are enthusiastic players. The first eleven has proved itself too strong for any other teams of the district. Sports are encouraged and Empire Day is an occasion for racing and display. A number of Europeans attended and the native treasury kindly provided a small sum for prizes.

Conclusion.

42. When choosing pupils to remain for a third year it became evident that all wished to stay. Discipline has been good and the boys show a respectful attitude and are ever ready to please. I am satisfied with the progress that has been made and realize that much has been accomplished on account of the willing assistance and co-operation on the part of the administration, the medical, the veterinary and forest officers.

A. E. Haarer,
Agricultural Lecturer in Charge.

APPENDIX I.

List of European Staff as on 31st December, 1934.

Director: E. Harrison, Head Office, Morogoro.

Senior Agricultural Officers: C. K. Latham, Lindi; A. S. Richardson, Mwanza; A. J. Wakefield, Moshi.

Agricultural Lecturer: A. E. Haarer, on leave.

Chief Scientific Officer: S. M. Gilbert, Coffee Research and Experimental Station, Lyamungu, Moshi.

Entomologist: A. H. Ritchie, Coffee Research and Experimental Station, Lyamungu, Moshi.

Assistant Entomologist: W. V. Harris, Laboratory, Morogoro.

Mycologist: G. B. Wallace, Coffee Research and Experimental Station, Lyamungu, Moshi.

Agricultural Chemist: H. B. Stent, temporarily stationed at Amani.

District Agricultural Officers: J. V. R. Brown, Morogoro; C. B. Garnett, Dar es Salaam; D. Sturdy, Arusha; R. M. Davies, Moshi; H. Musk, Rufiji and North Kilwa; C. Harvey, on leave; A. S. Stenhouse, Biharamulo; H. Marsland, Mpanganya, Rufiji; C. J. McGregor, Iheme, Iringa; A. H. Savile, Bukoba; N. V. Rounce, on leave; T. C. Cairns, Kigoma; R. D. Linton, Tabora; B. J. Hartley, M.B.E., Maswa; F. R. Sanders, Coffee Research and Experimental Station, Lyamungu, Moshi; J. Robertson, on leave; F. W. Thomas, Tukuyu; R. B. Allnutt, Lindi; J. R. Curry, Moshi; N. R. Fuggles-Couchman, Kilosa; G. W. Lock, Sisal Experiment Station, Tanga; D. Thornton, Mwanza; J. G. M. King, Shinyanga; J. C. Eyre, on leave; N. M. Wight, Morogoro; H. Gillman, Bukoba.

Senior Agricultural Assistants: T. H. Marshall, Experiment Station and Head Office, Morogoro; T. S. Jervis, on leave.

Agricultural Assistants: E. T. Ward, Iheme, Iringa; R. W. Collett, Mpapura, Mikindani; L. Leslie-Moore, Bukoba; G. S. Brown, Dar es Salaam; B. E. Eustace, Tukuyu; A. Taylor, Moshi; W. Sibley-Warne, Mpanganya, Rufiji; C. J. M. Krige, Morogoro Extension Farm, Kingolwira; W. C. Clarke, Ukiriguru, Mwanza; A. Young, Moshi; L. F. Higgens, on leave; R. Seager, Ukiriguru Extension Farm, Mwanza; A. E. Twells, Songea; A. E. Weirich, Lushoto; R. J. M. Swynnerton, Tanga; H. L. Brett, Bugufi, Biharamulo; H. A. B. Fowler, Sisal Experiment Station, Tanga; B. R. D. Eccles (temporary), Shinyanga; C. B. Gibbins (not yet arrived), Coffee Research and Experimental Station, Lyamungu, Moshi.

District Foremen: C. E. Allen, J. R. Anderson and A. F. Crosskill, Lindi Province.

Chief Clerk: W. E. Pownall, M.B.E., Head Office, Morogoro.

European Clerks: C. H. Taylor, Coffee Research and Experimental Station, Lyamungu, Moshi; D. F. T. Brown, on leave; J. B. Hean, Head Office, Morogoro.

APPENDIX II.

Plant and Seed Introductions, 1934.

Coffee seed (six varieties) from Porto Rico.
Indian rape seed from Bengal.
Malabar Cardamom seed from Ceylon.
Coffea Swynnertonii from Southern Rhodesia.
Nephelium Litchi from Mauritius.
Eleæocarpus serratus from Mauritius.
Carica papaya, var. Solo from the United States of America.
Lagerstræmia speciosa ,, ,, ,, ,,
Passiflora ligularis ,, ,, ,, ,,
,, *lutea* ,, ,, ,, ,,
Maize, var. Minnesota 13 ,, ,, ,, ,,
,, ,, Krug ,, ,, ,, ,,
,, ,, Pride of Saline ,, ,, ,, ,,
,, ,, Garrick ,, ,, ,, ,,
Crotalaria fulva ,, ,, ,, ,,
,, *goreensis* ,, ,, ,, ,,
,, *grantiana* ,, ,, ,, ,,
,, *spectabilis* ,, ,, ,, ,,
,, *valetonii* ,, ,, ,, ,,
Cotton seed selections:—
921, 955, 920, 045, 0245, 998R., 9312, 0123S.B., 9243, 0239, 0240, 050 from South Africa.
Tomato, "Matchless" seed from South Africa.
Onion, Giant Rocca ,, ,, ,,
,, ,, Zittau ,, ,, ,,
,, Yellow Cape ,, ,, ,,
Eucalyptus ficifolia ,, ,, ,,
,, *globulus* ,, ,, ,,
Acacia mollissima ,, ,, ,,
U/4 cotton strains ,, ,, ,,
Sorghum, witch-weed resistant from South Africa.
Artemisia sp. from Royal Botanic Gardens, Kew.
Rice seed, var. Demerara Creole from British Guiana.
,, ,, ,, No. 75 ,, ,, ,,
,, ,, ,, No. 79 ,, ,, ,,
,, ,, ,, Blue Stick ,, ,, ,,
,, ,, ,, Ramcajara ,, ,, ,,
,, ,, five varieties ,, ,, ,,
Kudzu vine from Japan.
Specacuanha from Kuala Lumpur.
Biari apple budwood from Palestine.
Lucerne seed from Australia.
Tanjore Rose seedlings from South India.
Red onion seed from India.
Lentil ,, ,,
Mango Scions ,, ,,
Pelargonium spp. from Kenya.
Sutton's Abundance Potatoes from Kenya.
Kerr's Pink English ,, ,, ,,
Senna, *Cassia* spp. from the Trades Commissioner, London.
Alexandrian Senna, *Cassia obovata*, from Egypt.
Cotton strains from Nyasaland.

APPENDIX III.

List of Ginneries Existing in 1934.

Province and District	Locality	Last licensed	Number of Gins		Licensee
			Saw	Roller	
Eastern:					
Dar es Salaam	Ruvu ...	1934/35	1	26	Vithaldas Haridas & Co., Ltd.
,,	Pugu ...	,,	1	18	Abdulrasul and Sons
Morogoro ...	Morogoro ...	,,	1	28	Tanganyika Cotton Co., Ltd.
,, ...	Mikesse ...	,,	—	20	East African Cotton Co., Ltd.
,, ...	Ngerengere...	,,	—	16	Liverpool-Uganda Co., Ltd.
,, ...	Mlali ...	1930/31	—	18	Tanganyika Cotton Co., Ltd.
,, ...	Duthumi ...	1934/35	1	12	,, ,, ,,
,, ...	Mkata ...	1930/31	—	12	,, ,, ,,
,, ...	Turiani ...	1931/32	—	13	,, ,, ,,
Kilosa ...	Kilosa ...	1934/35	—	18	Juma Haji
,, ...	*Kimamba ...	,,	—	12	Kimamba Planters Ginning Co., Ltd.
,, ...	Rudewa ...	,,	1	14	Tanganyika Cotton Co., Ltd.
,, ...	Msowero ...	,,	—	12	Kladitis and Samaris
Bagamoyo ...	Mandera ...	,,	—	8	Liverpool-Uganda Co., Ltd.
,, ...	†Kisauke ...	1928/29	—	2	S. G. Drosopoulos
Rufiji ...	Kilimani ...	1934/35	—	12	Kilimani Plantation
,, ...	Msomeni ...	,,	—	8	Liverpool-Uganda Co., Ltd.
,, ...	Logeloge ...	,,	—	8	D. Kepetsakos
Mahenge ...	Kiberege ...	,,	—	13	Vithaldas Haridas & Co., Ltd.
Lindi:					
Lindi ...	Lindi ...	1931/32	—	13	Mathuradas Kalidas
,, ...	Mtua ...	1934/35	—	6	,, ,,
Kilwa ...	Kikanda ...	1930/31	1	8	Jaffer Somji & Co.
Mikindani ...	Mikindani ...	1934/35	—	5	Mathuradas Kalidas
Tanga:					
Tanga ...	Tongoni ...	1929/30	1	8	G. Galanos
Handeni ...	Mamundu ...	1928/29	1	—	Kwashemshi Estates
,, ...	Sindeni ...	1933/34	1	2	,, ,,
Northern:					
Moshi ...	Moshi ...	1934/35	—	6	Moshi Trading Co.
,, ...	Himo ...	,,	1	12	,, ,,
Mbulu ...	Idulu ...	1926/27	—	5	M. Michaelakis
Western:					
Shinyanga ...	Usogore ...	1934/35	—	6	Bhagwanji Sunderji & Co.
,, ...	Luhombo ...	1930/31	4	—	B.E.A. Corporation, Ltd.
Lake:					
Mwanza ...	Mwanza ...	1934/35	—	20	Nakasero Trading Co., Ltd.
,, ...	Murutunguru	,,	1	10	White Fathers Mission
,, ...	Ihale ...	,,	—	11	Mwanza Cotton Trading Co.
,, ...	Bukumbi ...	,,	—	12	Bhagwanji Sunderji & Co.
Kwimba ...	Nyambiti ...	1932/33	2	6	—
,, ...	Pambani ...	1934/35	—	17	Kampala General Agency
Maswa ...	Nyanguge ...	1930/31	2	8	—
,, ...	Runere ...	,,	5	—	B.E.A. Corporation, Ltd.
,, ...	Malampaka	1934/35	5	—	Bhagwanji Sunderji & Co.
,, ...	Nasa ...	,,	—	12	Narandas Rajaram & Co.

*Non-Native cotton only. †Private ginnery.

APPENDIX IV.

EXPERIMENTAL STATIONS. (Rainfall in m.m. for the Season 1934.)

	January	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	Total for the Season
Coffee Research and Experimental Station	56·5	67·5	71·5	180·5	329·5	197·0	68·9	25·6	15·2	8·5	49·8	80·9	1151·4
Nyakato School, Bukoba	91·0	70·2	114·1	317·9	445·3	97·5	23·4	149·5	24·1	106·2	107·6	355·4	1902·2
Iheme, Iringa ...	182·7	123·1	79·1	63·6	27·8	0·5	0·8	Nil	9·0	Nil	40·5	166·6	693·7
Morogoro	75·0	35·0	183·9	142·8	99·3	31·3	16·1	18·3	1·0	Nil	18·8	98·9	721·3
Ukiriguru, Mwanza	49·5	67·5	67·3	110·9	30·5	Nil	12·7	2·5	Sept., 1933 19·1	Oct., 1933 43·2	Nov., 1933 38·3	Dec., 1933 71·5	513·0
Lubaga, Shinyanga	9·6	Trace	2·6	Nil	Nil	—	—	—	—	—	Nil	Nil	13·6

APPENDIX V.

Details of Expenditure.

The following table shows the provision and estimated expenditure for the period 1st January to 31st December, 1934:—

	Provision for the period 1/1/34 to 31/12/34		Estimated Expenditure for the period 1/1/34 to 31/12/34
Personal Emoluments:	£		£
Administrative (including total cost of Headquarter's staff)	5,469	...	5,312
Scientific staff	2,362	...	2,362
Field and Experiment Farm staff	27,923	...	27,043
Total Personal Emoluments ...	£35,754	...	£34,717
Other Charges:			
Travelling (including Railway Fares and Freight, Travelling and Transport Allowances, Transport and Passages)	8,112	...	7,791
Upkeep of Experiment Stations and Plantations	3,525	...	3,351
Upkeep of Nyakato Agricultural School	750	...	750
Purchase of Seeds and Upkeep of Ploughing Schools	225	...	130
Plant Sanitation and Purchase of Scientific Equipment	225	...	155
Expenditure from Cotton Tax	1,500	...	4,370
Agricultural Development, Special Services ...	200	...	198
General Expenditure	840	...	775
Total Other Charges, Departmental ...	£15,377	...	£17,520
Contributions, etc.:			
Scholarship Scheme Contribution	665	...	665
Imperial Agricultural Bureaux	200	...	200
Imperial Bureau of Entomology, Contribution ...	400	...	400
Imperial Bureau of Mycology, Contribution ...	250	...	250
East African Agricultural Research Station, Contribution	6,000	...	6,000
Colonial Agricultural Service, Contribution to Central Fund	180	...	180
Total Contributions, etc. ...	£7,695	...	£7,695
Special Expenditure:			
Anti-Locust Measures	6,000	...	5,650
Purchase of Tea Seed	113	...	113
Purchase of Native Tobacco	2,615	...	2,119
Purchase of Wheat Seed	50	...	51
Special Development, Lindi Province	1,750	...	1,560
Coffee Research Station	5,000	...	4,354
Empire Cotton Growing Corporation Grant:			
Capital	3,000	...	1,058
Recurrent	2,075	...	1,848
Sisal Experiment Station	590	...	320
Grant to Sisal Tax Board	1,460	...	1,434
Total Special Expenditure ...	£22,653	...	£18,507